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(Affiliated to the International Union of Leather Technologists and Chemists Societies GENEVA)

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Editorial

WATER FOOTPRINT OF LEATHER INDUSTRY IN INDIA

Not only agricultural products contain virtual water – most studies to date have been limited to the study of virtual water in crops – but industrial products and services also contain virtual water. Leather industry is one of such industries that produce such products which have a very high value of virtual water. Similarly it also experiences a large water footprint.

The virtual water from feed, drinking and servicing is integrated over its life span to get the total virtual water content of a live animal, which is 5252 m³/animal. As the live weight of the animal is 0.545 ton, the virtual water content of bovine cattle in Canada is equivalent to 9636 m³/ton of live animal and if an animal ready to be slaughtered is traded alive the total virtual water traded is about 9636 m³/ton. The primary products of the animal are the carcass, offal, semen and raw skin. The virtual water contents of these primary products are calculated as:

- carcass 16100 m³/ton
- offal 9100 m³/ton
- semen 378800 m³/ton
- skin 14100 m³/ton

Leather industry deals with the skin and virtual water of its primary raw material is 14100m³/ton.

Water footprint of a leather industry depends on its intake of raw materials and the quantum of its products. Normally leather consumes 30 m³ of water per ton of leather in the process. Out of this 2 m³ is actually consumed and 28 m³ is released into environment as waste water. This waste water contains high amount of toxic chemicals that ultimately adds to the grey water footprint of the industry. For the tanned leather from a bovine cow it costs about 16000 cubic meters of water per ton of leather considering the quantum of grey water footprint and water used for other utilities. The grey WF is calculated as the volume of water that is required to dilute pollutants to such an extent that the quality of the water remains above agreed water quality standards.

India being a very large and potential producer of leather and leather goods Indian leather industry has a very high water footprint. By exporting leather and leather goods India exports a very high amount of virtual water. This amounts to approximately 6960 Mm³ of virtual water in 2010.

India's export figure on leather and leather goods in 2010

ITEM CAPACITY

Hides 65 million pieces

Skins 170 million pieces

Leather Footwear 909 million pairs

Leather shoe uppers 100 million pairs

Leather Garments 16 million pieces

Leather Goods 63 million pieces

Industrial Gloves 52 million pairs

Saddlery & Harness 12.50 million pieces

Water requirement in 2010 65.74 Mm³/ day

Water requirement in 2025 93.08 Mm³/ day

In India leather industry mostly depends on the groundwater resources and a part of the waste water is still being discharged into the environment causing serious environmental and human health hazards. Now time has come that industries including leather should take up some proactive measures to mitigate all adverse environmental situations.

Hony. Editor, JILTA

FROM THE DESK OF THE GENERAL SECRETARY

DURGAPUR LEXPO – II

Being inspired by the success of our maiden venture at Durgapur last year, we are going ahead with organizing Lexpo for the second time in succession at Gandhi More Maidan in Durgapur from 26th November to 11th December 2011.

SILIGURI LEXPO -XVIII

The 18th Lexpo at Siliguri Kanchanjungha Krirangan adjacent ground will be held from 17th January to 02nd February 2012.

PRIVILEGE HEALTH CARD

The Calcutta Medical Research Institute (CMRI) 7/2 Diamond Harbour Road, Kolkata has been provided with a list of our members residing in Kolkata pin code area and also in West Bengal other than Kolkata pin code area so that they can issue privilege Health Cards to such members. Initially the facility is extended to the members and their spouses only.

53rd ANNUAL GENERAL MEETING

This was held at the auditorium of Jagadis Bose National Talent Search, 1300 Rajdanga Main Road, Kolkata 700 107 at 3.0 pm on Thursday the 22nd September, 2011.

Mr. Arnab Jha chaired the AGM as per the notified Agenda. Refreshments were served at the end of the meeting.

One of the Agenda items of the AGM was formal announcement of the results of the election held on 5th and 6th August 2011 for the reconstitution of the Executive Committee of ILTA for the term 2011-2013. Mr. S.K. Roy, retired Asst. Director, MSME Development Institute who acted as the

ILTA News

Returning Officer and was present at the AGM formally declared the results which are as follows:

President	:	Mr. Arnab Jha
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“ “ (Southern Region)	:	Dr. Bhabendra Nath Das
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So far as election to ILTA Southern Regional Committee and Northern Regional Committee for 2011-2013 is concerned, no nomination was received for any post.

Susanta Mallick
General Secretary

**Executive Committee Members meet every Thursday
at 18-30 hrs. at ILTA Office.
Members willing to participate are most welcome.**

CLEANER PROCESSING OR TECHNOLOGY VIS-À-VIS CONVENTIONAL TECHNOLOGIES

BILAL AHMAD BHAT

Receiver of B. M. Das Memorial Medal and J. M. Dey Memorial Medal
at the 61st Foundation Day Celebration of ILTA on 14th August, 2011.

INTRODUCTION :

Pollution prevention by adopting cleaner technology is the best option for tannery management problems implementation of cleaner technologies, water management , waste management ,recovery and reuse of chemicals in the tanneries are very important for sustainable growth of the leather industry. In leather processing large quantities of water as much as 40-50 litres of water per kg of raw materials is used. it is also generally known that amount of toxic materials discharged in the tannery effluent arises to a greater extent from the pretanning operations .leather processing employs the complex principles of bio-technology and inorganic chemistry for achieving the desired technical objectives. over 80% of organic pollution load in BOD is generated in beam house of which 10% is derived from soak liquors,70% from unhairing/liming,5% from deliming and bating and 15% from the rest of the processes .the soak water provides 60% salinity and the rest comes from pickling and other operation seven though the conventional practices do allow tanners to achieve satisfactory leather quality, they suffer from disadvantages like longer processing times and large working space and environmental problems. these conventional practices are based on techniques standardized prior to the recognition of their impact on environment waste minimization/low waste concept is the under lying principle for resource conservation and inplant control to achieve production consistency and reduction in production problems. in leather processing, chrome tanning is an important step which has raised serious ecological concerns in leather sector .the international regulatory laws stipulate concentrations of 0.3-2.0 ppm of chromium in industrial waste water. so several technological options have been developed to render chrome tanning eco-friendly. among the options developed ,one is high exhaust chrome tanning system, the second option is chrome recovery and reuse and the third is replacement of chrome partially or completely with ecologically acceptable tanning compounds . similarly in post tanning operations , the conventional practices required a total reappraisal in the light of current environmental regulations.

RAW STOCK

- PRESERVATION OF FRESH OR COOLED HIDES AND SKINS
 - » CONVENTIONAL PROCESS:
 - » DRYING
 - » DRY SALTING
 - » AIR DRYING
 - » FRAME DRYING
 - » FREEZING
- CLEANER PROCESS:
- » CHEMICAL METHODS
- » SILICA BASED PRESERVATION
- » USE OF ANTICEPTICS(BIO SIDES)
- » NEEM BASED PRESERVATION
- » CHILLING METHOD
- » GAMMA RADIATION

Preservation Of Fresh Or Cooled Hides And Skins:

Fresh or uncured raw stock is available to tanneries in many countries. Whenever possible ,treatment of fresh hides and skins is the best solution to reduce salt pollution .The time elapsing between slaughter and further treatment (whether curing itself or the initiating of wet processing in the tannery) must not exceed a few hours. When an abattoir and a tannery are operationally linked, fresh raw stock may be used, but excess above the capacity of the tannery must be handled differently. Beyond this short period, it is necessary to cool the hides and skins, either in ice or cold air. Cold air is necessary if hides are to be transported over long distance. Storage below 4°C can extend preservation for up to three weeks, under ideal conditions, although some dehydration is to be expected. This system of retaining raw stock quality is used in Europe, by transporting raw stock in refrigerated lorries ,but it is recognized that this may not be feasible or economical in developing economies. Raw stock may be preserved in ice, but storage is more problematical than chilling, due to melting of the ice, run-off of water and the potential for bacterial growth on wetted pelt.

Treatment Of Fresh Or Cooled Hides And Skins:

This type of treatment exists in many countries throughout the world. It was applied at the origin in large South American tanneries where 75% of the total hides processed are fresh hides coming from slaughterhouses. Time elapsing between slaughtering and further treatment (e.g. beam house processing) must not exceed a few hours, mainly when the temperature of air is high.

Beyond this period, it is necessary to cool the hides and skins. Cold air is interesting if hides are transported over a long distance. Using ice gives faster cooling and easier freight conditions. Storage below 4 centigrades yields good preservation up to three weeks.

Of course, sorting is difficult before hide treatment and this can cause great difficulties due to the disparity of the characteristics of hides and skins obtained in slaughterhouses. Cooling with cold air needs to be applied on individual hides and skins hung on hooks, as hides can maintain in a pile, a high temperature for many hours, even when the pile is in a cold room.

Regarding this problem, it is preferable to store hides and skins in cases filled with ice, before reaching the beam house. Such a process is gaining ground in Switzerland, Germany and Austria, where regulations limit the use of salt for preservation. During the preparation of the ice, it is now possible to add biocide that will continue to protect the hide, even if the ice de freezes.

Drying:

Shade drying of small skins is a low cost and environmentally acceptable process in some climates. Controlled air-drying using heat pump or other system is suitable for any climate.

Dry Salting:

Dry salting, combining salt curing and shade drying, can minimize the amount of salt used for preservation of skins and hides.

Use Of Antiseptics:

The use of antiseptics with low environment impact and toxicity can help to increase storage time of fresh or chilled hides and skins. Suitable preservatives that are used around the world include: TCMTB, isothiazolones, potassium dimethyl dithiocarbamate, sodium chlorite, benzalkonium chloride, sodium fluoride and boric acid. Their use must be regularly reviewed, to reflect changing legislation, because they will be discharged in the effluent. Some of these agents, that may have both bactericidal and fungicidal properties, are also appropriate for soaking, pickle and wet blue preservation.

Partial Salt Elimination:

It is possible to eliminate up to 10% of the salt added to hides and skins for preservation, by using hand shaking, mechanical brushes or a suitable drum. The salt can be reused for pickle processes after dissolution and removal of solids, but it must not be used for curing purposes because it is too contaminated with bacteria, particularly halophilic or halotolerant bacteria, which can cause so called red heat. This method of salt recovery gives a partial answer to the salt pollution problem. Neither brine curing nor salt curing can be considered as cleaner technologies, even if pre-fleshing green hides reduces this waste. It is recognised that salt curing is one of the greater contributors to the environmental impact of tannery operations. Even

recovering some of it has limited benefits, because its reuse is extremely limited, its ecological disposal is difficult impossible and the cost of fresh salt is so low.

BEAMHOUSE PROCESSING:

The new generation of drums and processors facilitate efficient draining and washing, and allow the routine use of low floats for processing, thereby resulting in significant savings in water consumption.

Soaking:

Normally for soaking in conventional system, three changes of the water are given at 300% per soak which lead to larger consumption of water. By cleaner process to reduce the consumption of water in soaking ,counter current soaking system can be followed and by this system there is no deterioration in physical or functional property in resultant leather.

The consumption of fresh water can be minimised by using a countercurrent system of washing, to concentrate the salt (if present) and the other soluble materials, such as dirt and blood. Utilisation of all antiseptics used for preservation should be under regular review. Additional cleaner technology that can be applied at this stage is the fleshing of green hides after soaking. It yields a lower quantity of fleshings, with a neutral pH. Green fleshings are more valuable than limed fleshings with regard to tallow recovery, because the green fleshings are not subjected to the hydrolysing liming process. In this way, the amount of recovered tallow is greater and the content of undesirable free fatty acid is much lower, so the quality is better. An associated problem with this approach is the presence of dung on hides, which causes the fleshing blade to cut into hide, thereby damaging the pelt in an economically unacceptable way. Removal of dried-on dung by methods other than soaking is difficult. However, dung removal is a pre-requisite to processing.

Pollution Load Of Soaking Effluents Of Differently Preserved Hides:

Pollution	Load kg/t raw hide	
	SALTED	UNSALTED
Total Solid Range	159-231	32-42
Average	195	37
COD Range	20-23	12-19
Average	21	16
BOD Range	7.7-8.1	6.3-10
Average	7.9	8.8

No significant differences in the organic pollution load have been registered when soaking salted/unsalted hides. The variances in the total solids load are associated with chloride elimination.

Classical Unhairing-Liming Process:

Liming is done by in the conventional system by hair destructive method using sodium sulphide and lime. By this method not only increases BOD/COD levels in effluent . But also interferes with the bacterial oxidation process it self. So ,it is very important to adopt hair saving process to reduce BOD/COD level in the effluent. This method can be followed by employing dehairing enzyme alone or combination of enzyme and sulphide.

The enzymatic treatment of hides and skins can be considered as a cleaner technology only if the amount of sodium sulphide is reduced substantially. However it is not yet possible to replace totally sodium sulphide in processing skins and hides. There are other agents available that reduce the amount of sulphide in liming, e.g. organic sulphur compounds (mercaptoethanol, salts of thioglycolic acid, formamidinesulphinic acid) and amines based proprietary products. However, it should be borne in mind that all hair dissolving processes will contribute to the COD/BOD of tannery effluents.

Hair Saving Unhairing-Liming Methods:

For traditional skin production, painting and sweating may be considered cleaner technologies. Recovery of hair before dissolution, either when it is separated during the liming, or at the end of a hair saving process, can lead to a COD reduction of 15- 20% for the mixed tannery effluent, and a total nitrogen decrease of 25-30% . It is an advantage to filter off the loosened hair as soon as possible and higher COD and nitrogen reduction can be obtained. This process can be considered as a cleaner technology if the hair is utilised, even as a nitrogen source. There are several established methods of hair saving, routinely used in industry. However, is it recognised that they do not provide a complete effect, since each incorporates a hair dissolving step, to deal with residual short hairs.

Advantages Of Sulphide Free Unhairing System By Using Enzymes:

- Pollution free unhairing system
 - Free from stains & cleaner pelt
 - Strength properties are better
 - No odour during unhairing
 - Resulting more area
 - Energy cost for the treatment of effluent is lesser

GREEN FLESHING:

Another important step in the cleaner technology is the green fleshing. Green fleshing helps to reduce the consumption of chemicals because it reduces the weight of the stock by 10%. Apart from reduction in the consumption of chemicals, green fleshing facilitates better penetration of chemicals in the subsequent operations. By green fleshing, the consumption of chemicals gets reduced and thereby the load on the effluent also gets reduced.

The Direct Recycling Of Liming Float:

Direct recycling can be applied when there is a good control level in the tannery. Resulting advantages are savings in sodium sulphide (up to 40%) and in lime (up to 50%). It can give a decrease of 30-40% of the COD and 35% of the nitrogen for the mixed effluent. The quality of the leather produced can be affected negatively through this recycling process, unless the unhairing and opening up processes are used in two steps. This is because the suspended melanin and undissolved cuticle fragments from the dissolved hair (referred to as scud) are driven into the grain by mechanical action, making it dirty. This cleaner technology is industrialised in several large bovine tanneries for shoe upper leather. The success depends on how the hair is removed and how well the recycled liquors are cleaned up before they are recycled.

Splitting Limed Hides:

Faced with the difficulties of upgrading the chromium-tanned split waste, splitting in the lime can be considered as a cleaner technology, as it saves chromium and yields a byproduct that can be used for food casings or for the production of gelatin.

DELIMING:

- In conventional process limed pelts are treated by acid salts like ammonium sulfate or ammonium chloride in the drum with sufficient quantity of water to remove lime from the pelts, results in pollution problems because of oxidation of ammonium which is toxic to aquatic life. Up to 40% of a tannery's production of ammoniacal nitrogen comes from the use of ammonium salts during the deliming process. To avoid these kinds of problems, carbon dioxide has been developed as a cleaner technology to reduce nitrogen compounds. We also reduce the pollution by using of lactic acid.

CO₂ Deliming:

Up to 40% of a tannery's production of ammoniacal nitrogen comes from the use of ammonium salts during the deliming process. Carbon dioxide deliming can be considered as a cleaner technology giving good results on light bovine pelts (thickness less than 3 mm). For thicker hides, it is necessary to increase float temperature (up to 35°C) and/or process duration and/or to add small amounts of deliming auxiliaries. In order to effectively eliminate the creation of hydrogen sulphide as the pH of the deliming solution falls, 0.1% hydrogen peroxide can be used to scavenge residual sulphide. The grain enamel should be allowed to delime for perhaps

5 minutes, to guard against oxidation damage, then the peroxide can be added safely. If the pH falls below 7, in the case of black or red hides they may appear dirty due to the retention of melanin in the depleted grain layer. If the pH of CO₂ delimiting float is lower compared to common procedure, special bates can be used. Also, bates with a lower content of ammonium are available.

ADVANTAGES OF CARBON DIOXIDE DELIMITING:

- Reduce ammonia odour in the tannery
- Reduction in BOD level by 50%
- Reduce risk of acid shocks in the pelt & achievement of gradual reduction in pH which is very much desirable

DISADVANTAGES OF CARBON DIOXIDE DELIMITING:

- It takes lot of time to delimit the pelt.
- The trough and trough delimiting is not possible.

Other Ammonium-Free Delimiting:

Ammonium-free delimiting agents, such as weak acids or esters, can totally or partially replace ammonium salts used for conventional delimiting. However, in comparison with CO₂ delimiting the resulting COD is often higher, due to the contribution from the reagent. Cost and slowness of reaction make them less viable.

Reduced Salt Use In Pickling Floats:

When pickling and tanning steps are separated, the recycling of pickling floats can save up to 80% of normal salt used and 20 to 25% of the pickling acid. When they are conducted as one step, the neutral electrolyte can still be recycled in the spent liquor and reused for pickling. However, in the absence of analytical data, it must be assumed that much of the formate in the system will be bound to chromium, either on the leather or in solution.

For wool-on sheepskins, using long floats over 150%, recycling of pickling and tanning liquors is current and routine practice. It is also feasible to recycle bating floats. Salt concentrations in pickling floats can also be reduced by using non-swelling acids, which, however, might affect the leather character.

Degreasing Operations:

Solvent degreasing is still in use. This practice can lead to a cleaner technology when the solvent is recovered, the extraction brines are recycled and the natural grease is recovered for commercial use. Discharge of solvents is unavoidable with solvent degreasing, but alternative technologies can be applied for high quality skin production. On wool-on lambskins, it is a common practice to undertake dry solvent extraction when crusted. The use of non-solvent methods implies the use of higher amounts of surfactants. Ethoxylated

fatty alcohols are recommended instead of the more widely used ethoxylated alkylphenols, because they are more easily degraded and the use of the latter are to be restricted in the EU. The COD from aqueous treatment may amount as much as 200,000 mg/l, due to the content of natural grease and surfactants (1g/l of natural grease is about 2,900mg/l COD, and 1g/l ethoxylated alkylphenol is about 2,300mg/l COD). To ensure complete mobilisation, aqueous degreasing would, ideally, be carried out at a temperature above the melting point of the grease. However, the melting point of the grease is normally very close to the shrinkage temperature of the skin. For example, the melting point of sheepskin grease is approximately 42°C, whereas the shrinkage temperature of sheepskin pickled pelt is approximately 50°C. Therefore, the risk of heat damage to the pelt precludes the use of temperatures above the melting point of the grease. The grease may also be contained within lipocytes, further limiting its dispersal.

The aqueous degreasing of pigskins may be assisted by the use of proteolytic enzymes to degrade the lipocyte and, thus, mobilise the grease. However, this may not be possible for sheepskins where the fibre structure is more susceptible to the proteolytic activity of the enzyme.

TANNING OPERATIONS:

THE CHROMIUM PRESENT IN THE TANNERY EFFLUENT IS BELIEVED TO BEHAVE AS A HAZARDOUS POLLUTANT .CURRENTLY USED CHROME TANNING SALTS AND METHOD EMPLOYED LEAD TO A DISCHARGE OF SOLUTIONS WITH CHROMIUM CONCENTRATION IN THE RANGE OF 1500-4000 ppm. BUT THE PERMISSIBLE LEVELS OF CHROME IN THE WASTE WATER IS IN THE RANGE OF 0.3-2.0 ppm. AS PER THE ENVIRONMENTAL REGULATORY AGENCIES.CHROME TANNING ALSO CONTRIBUTES SIGNIFICANTLY TO TDS TO AN EXTENT OF 25-35% (BOTH PICKLING AND CHROME TANNING PUT TOGETHER).THERE ARE QUITE A FEW VIABLE OPTIONS TO OVER COME THESE PROBLEMS

CHROME RECOVERY AND REUSE

PARTIAL REPLACEMENT OF CHROME TANNING AGENT BY OTHER TANNING AGENT

HIGH EXHAUST TANNING SYSTEM

GLY OXALIC METHOD

THEREFORE, THE SOLUTION TO THE PROBLEM RESTS IN THE REDUCTION OF DISCHARGE OF CHROME IN THE EFFLUENT BY BETTER CHROME MANAGEMENT SYSTEM.

Chromium tanning salts are used today in 85% of tanning processes around the world. Only the trivalent form is used for tanning operations and this chemical cannot be replaced by another to give the same quality of leather.

An argument for continuing to use basic chromium (III) sulphate is the ease of managing its discharge into the environment and its low environmental impact. Chromium (VI), a recognised carcinogen, is not used in leather manufacturing processes.

Wet-White Pre-Tanning:

The rationale behind this notion is to pre-tan or pre-treat the hide, in order to be able to split and shave prior to chrome tanning, so that less tanned waste is created. The rationale is to confer resistance to the frictional heating of the pelt surface during shaving. Ideally, the pre-treatment should be reversible, so that chrome tanning is conducted on unchanged pelt. This process can be considered as a cleaner technology if the chemicals used are neither toxic nor cause adverse environmental impact. Aluminium (III), titanium (IV) and zirconium (IV) have been suggested for this role: they are not listed as hazardous, although restricted in several countries, but their degree of reversibility depends on how they have been applied. Aldehydic tanning agents can be considered as leading to a cleaner process, according to local regulations, but their reactions are completely irreversible, so contribute to a different character in the leather. Syntans are an option, because their action is more reversible. The alternative approach is to change the properties of the pelt, to make it less prone to distort when the surface is struck by the shaving blade. This can be achieved by reducing the ability of the fibre structure to slip over itself: this is best achieved with hydrated silica, used in the fabric industry for the same purpose. Silica interacts weakly with collagen, in a non-tanning manner, and the effect can be reversed: any discharged silica has negligible environmental impact.

Direct Recycling Of Chromium Tanning Floats:

When applied under strict control, this can markedly limit chromium from tanning in the effluent. Savings can be obtained from the process: a reduction of 20% of the chromium used in a conventional tannery process, up to 50% for wool-on sheepskins, and substantial reduction in the amount of salt used, since it too is recycled. Excess chromium containing liquor that cannot be easily recycled may be precipitated and then recycled. Usually such re-use produces wet blue that is a little different in colour. Acidifying recycled liquor to pH 1 can revert the chrome species to those in fresh chrome liquor.

Recovery After Precipitation:

When large quantities of chromium bearing floats are recovered, recycling after precipitation is another solution for chromium recovery. Precipitants that might be used include sodium carbonate, sodium hydroxide, and magnesium oxide. The difference between them is the effect they have on the precipitate: the faster the basifying reaction, which is dependent on the alkalinity and the solubility, the more voluminous is the precipitate and the slower is the settling rate. Therefore, the greatest sludge density is obtained using magnesium oxide. The addition of polyelectrolyte can improve flocculation.

Sludge obtained after sedimentation and optional filtration is re-dissolved in sulphuric acid, to control the desired basicity in the product. In order to ensure complete solubilisation of the chrome sludge, the reaction should be conducted at $>70^{\circ}\text{C}$. For conventional tanning, it is possible, with this process, to obtain a clarified effluent, with less than 10 mg/l of chromium expressed in Cr, which might be reused for the next pickling or tanning float. The clarified effluent can also be reused for first soaking float. Using recovered chrome for tanning results in wet blue that is slightly paler than conventional production. Further the re-use of precipitated chromium will lead to an increase in the neutral salts in the effluent.

High Exhaustion Tanning Process:

In order to reduce chromium concentration in the waste float, high exhaustion chromium salts, adapted basification products and/or temperature increase can be used. In essence, all proprietary options are based on higher astringency, by employing higher pH in basification, but most importantly elevated temperature.

Chromium-Free Tanning:

In most cases, chromium tanning should be considered as the best available technology. Many alternative formulations have been proposed, but none can exhibit the versatility of chromium (III) for making a wide variety of leathers. Also, the high hydrothermal stability of chrome leather is a prerequisite for many modern applications of leather.

Vegetable tanning is the traditional alternative to chrome tanning: conducted by a dry drum process, or in closed circuit vats, it can minimise waste and must be included in these considerations. Due to the high pollution load and slow biodegradability, conventional vegetable tanning cannot be considered more environmentally friendly than chrome tanning. Vegetable tanning has limited applications, because of the low hydrothermal stability, the filling effect and the hydrophilicity of the resulting leathers.

Recovery of vegetable tanning floats by ultrafiltration is used in several European tanneries and the recovered tannins may be used in the tanning process. Tanning with organic tanning agents, using polymers or condensed plant polyphenols with an aldehydic crosslinker, can produce mineral-free leather, matching the high hydrothermal stability of chrome leather. However, they do not have the same characteristics as chromium tanned leather, because they are much more filled and hydrophilic.

Metal-free leathers are being successfully used to produce high quality speciality leathers, for example, automotive leathers with good thermal stability. Semi-metal tanning can produce chrome-free leather, with equally high hydrothermal stability. It is a combination of a metal salt, preferably but not exclusively aluminium (III) and a plant polyphenol containing pyrogallol groups, often in the form of hydrolysable tannins. A life-cycle analysis of each process needs to be taken into account.

POST-TANNING OPERATIONS:

When the use of chromium is required for retanning operations, the same consideration should be given as for chrome tanning. Absence of environmentally unsound dyestuffs, especially those containing benzidine and other banned aromatic amines, and of halogenated oils in fatliquors, form essential elements of cleaner processing. High level of exhaustion for syntans, dyes and fatliquors are also to be considered: in each case, the chemical principles and conditions for reaction with the leather must be optimized.

FINISHING OPERATIONS:

The use of water-based finishes is fundamental for a cleaner process, but the inherent need to use crosslinkers should be kept in mind. Chemicals used in finishing must not contain any environmentally undesirable heavy metals or other restricted products. Water based formulations (containing low quantities of solvent) are

available for spray dyeing. Finishing products have to meet the current limits imposed by environmental and workers health regulations. The equipment used is extensive. Roller coating or curtain coating machines are more desirable from an environmental point of view, but they cannot be used for all types of leather. For other types, spraying units with economizers and high volume low pressure (HVLP) spray guns can reduce discharges to the environment.

Process Related Changes To Enhance Resource Utilisation And Waste Minimization:

Manufacturing processes were designed in an era when productivity and quality were in the minds of process engineers. The new attention on resource conservation and minimising pollution has yielded a wide range of process improvements in every industrial sector. Leather sector is no exception. Typical examples are as below:

- Trimming at early stages.
- Green fleshing
- Chrome - free pretanning operations
- Lime splitting.

In order to make the treatment systems viable and compliant to the regulations of environmental agencies in-plant pollution control measures are gaining prominence. Some of the technologies commercially exploited are listed below:

*

- Ø Salt-free curing (Use of bio-cides, dehydrants, drying, preservative immobilised on solid matrix with a recycle option etc.)
- Ø Hair - save sulfide free unhairing
- Ø Ammonia free deliming
- Ø Chrome management options
- Ø Eco-benign post tanning
- Ø Newer finishing techniques
- Ø Approaches for increase in area yield
- Ø Better unit value realisation through generation of multiple splits and conversion to appropriate products
- Ø Recourses to bio- processing

RECYCLING

INTRODUCTION

Recycling typically means a second utilization for the same purpose, reuse may mean utilization for different purposes and recovery incorporates an isolation step. Recovered material can then be recycled or reused. Recycling technologies have been used for long time in vegetable tanning processes, indeed the conventional

counter-current method incorporates recycling as a fundamental element of the technology. Simple recycling technologies need some control to prevent any deviation in the tannery process. A laboratory with basic analytical equipment is desirable.

BEAMHOUSE PROCESS:

To reduce the volume of saline effluents, particularly if this segregated float needs to be evaporated or specifically processed, it is possible to reuse soaking floats in a counter current method, analogous to vegetable tanning. Here, the pelts progress into cleaner float and the contaminated floats move towards the dirt soak. Only the dirt soak liquor, in which dirt and salt are accumulated, are discharged to waste and treatment. This decreases the amount of water to be evaporated, when salinity is restricted, and reduces the presence of biocides in effluent. However, it does not solve the problem of what to do with the dirt soak solution. Lagooning where feasible reduces the volume, but the salt remains.

The unhairing-liming float can also be reused for the next process. It must be taken into account that the recovery rate of the liming float should not exceed 75 % in order to limit the nitrogen concentration. Besides recycling materials (pumps, fine screening, storage tanks), it is sometimes necessary to warm the float before reuse and also to screen or skim it in order to eliminate undesirable floating solids and to remove hair and grease from the surface. Without any sedimentation, an industrial recycling process can save 35 to 40% of sodium sulfide and 40 to 45% of the lime (with classical process quantities of 2.5 %). Excessive quantities of lime should be avoided during the process; it is worth recalling in this regard that the theoretical requirement for bovine hide is about 1.2%.

TANNING PROCESS

Degreasing Float:

When sheepskins are solvent degreased, recycling of the residual solvent after distillation is currently operated. Furthermore, the extraction brine is also easy to reuse, to save sodium chloride.

Pickling Float:

Recycling of pickling float has been proven to be highly satisfactory in terms of salt savings and partly for acid savings. There is no great difficulty if density and acidity of the float can be regularly controlled.

Tanning Float:

The most common practice is to collect the residual tanning float, to filter it, to adjust its acidity, then to reuse it as a new tanning float before adding fresh chromium salt. The recovered volume may be more than required for subsequent tanning operations, but it is possible to reuse the liquor in post tanning.

Another possibility is to use the tanning float for a pre-tanning process. In this case, 60% of the residual chromium can be recovered. When pickling and tanning are carried out in the same float, it is also possible to collect the residual tanning float, to filter and acidify it and reuse it as a pickling float.

Post-tanning Process:

It is much less feasible to recycle post-tanning floats, since the chemical condition required for the steps may be different and steps tend to be conducted sequentially in the same float. Therefore the problem of contamination is compounded, especially since these steps vary greatly, even in a single factory. Thus, recycling technology cannot be recommended.

Summary of pollution loads discharged in effluents from individual processing operations

Operation	Technology	Pollution load kg/t raw hide								
		SS	COD	BOD	Cr	S2	NH3-N	TKN	CL-	SO42-
		Conventional technology		Advanced technology (cleaner tech.)						
Soaking	C	11-17	22-33	7-11	-	-	0.1-0.2	1-2	85-113	01-02
	A	11-17	20-25	7-9	-	-	0.1-0.2	1-2	5-10	1-2
Liming	C	53-97	79-122	28-45	-	3.9-8.7	4-5	6-8	5-15	1-2
	A	14-26	46-65	16-24	-	4-7	0.1-0.2	3-4	1-2	1-2
Deliming, Bating	C	8-12	13-20	5-9	-	0.1-0.3	2.6-3.9	3-5	2-4	10-26
	A	8-12	13-20	5-9	-	0-0.1	0.2-0.4	0.6-1.5	1-2	1-2
Tanning	C	5-10	7-11	2-4	2-5	-	0.6-0.9	0.6-0.9	40-60	30-55
	A	1-2	7-11	2-4	0.05-0.1	-	0.1-0.2	0.1-0.2	20-35	10-22
Post-tanning	C	6-11	24-40	8-15	1-2	-	0.3-0.5	1-2	5-10	10-25
	A	1-2	10-12	3-5	0.1-0.4	-	0.1-0.2	0.2-0.5	3-6	4-09
Finishing	C	0-2	0-5	0-2	-	-	-	-	-	-
	A	0-2	0	0	-	-	-	-	-	-
Total	C	83-149	145-231	50-86	3-7	4-9	4-6	12-18	137-202	52-110
	A	35-61	96-133	33-51	0.15-0.5	0.4-0.8	0.6-1.2	5-8	30-55	17-37

Water consumption in individual processing operations

C - Conventional technology

A - Advanced technology

Operation	Discharge m ³ /t raw hide	
	C	A
Soaking	7-9	2.0
Liming	9-15	4.4
Deliming, Bating	7-11	2.0
Tanning	3-5	0.5
Post-Tanning	7-13	3.0
Finishing	1-3	0
Total	34-56	12

WATER MANAGEMENT:

Leather production is a water intensive industry, therefore measurement and control of consumption are important and essential points of water management. In many countries water has become a scarce commodity and the costs for the consumption and discharge of water increase regularly. Water has to be managed properly and several options are available to minimise the overall consumption of water. Reduction: The first step is reduction of water consumption, with strict measurement and control of consumption. Low float processing, batch-type washing instead of rinsing and combining processes (compact recipes) are practical examples of technologies to reduce water consumption by 30% or more. However, lower volume of water will result in higher pollutants concentration, but that will be partially offset by the greater efficiency of shorter float process steps. Limits to reducing float length must be borne in mind, since not all processes benefit from reduced float length. Recycling: Certain specific processes are suitable for recycling of floats, although in most cases installations for treatment are necessary. Examples are; soaking, liming, unhairing, pickling and chrome tanning liquors, which can reduce the overall water consumption by 20-40%. Re-use: Biologically treated effluent offers the opportunity of replacing a certain amount of the process floats, such as the beam house process floats, with treated water. Depending on the type and efficiency of the treatment process additional operations might be necessary, such as filtration and disinfection, to meet the required water quality standards. Membrane systems provide the possibility of reusing treated effluents, provided that most of the residual organic matter is removed and disposal of the concentrate is achievable.

REDUCTION IN CHEMICAL USE :

Processes should be optimized with regard to chemical use to minimize waste. Reduced floats allow reduction in chemical use (liming, deliming and pickling). However, due regard should be placed on the chemical and

biochemical principles of processing, in order to avoid the unnecessary excessive chemical use, for example, lime, sulphide, salt, chrome, dyes, lubricants, etc.

Wastes Generation From Leather Manufacturing Process :

Unit Process/ Operation	Type of Waste Generated	Characteristics/Effect of Waste
Raw Trimming	Trimming – Solid Waste	Deterioration of Land and Soil
Desalting	Salt - Solid waste	Increases TDS and Salinity of Soil and Water
Soaking	Wastewater	Increases TDS and Salinity of Soil and Water
Liming	Wastewater	Increases TDS and Alkalinity of Soil and Water
Unhairing	Hair sludge	Deterioration of Land and Soil
Reliming	Wastewater	Increases TDS and Alkalinity of Soil and Water
Fleshing	Fleshings – Solid Waste	Deterioration of Land and Soil
Deliming	Wastewater	Increases TDS and Ammonia level
Pickling	Wastewater	Increases TDS and Salinity of Soil and Water
Tanning	Chrome Tanning	Increases TDS and Soil and Water Chromium Contamination
	Vegetable Tanning	Increases TDS and Soil and Water Tanning Contamination
Neutralization	Wastewater	Increases TDS
Retanning, Dyeing and Fatliquoring	Wastewater	Increases TDS, BOD and COD
Shaving	Shavings – Solid Waste	Deterioration of Land and Soil
Buffing	Buffing Dust - Solid waste	Deterioration of Land and Soil
Finishing	Finish sludge - Solid waste	Deterioration of Land and Soil

Characteristics Of Tannery Wastewaters:

Parameter	Soaking	Liming/ reliming	Deliming	Pickling	Chrome tanning	Neutra- lisation	Rechrome- ing dyeing fatliquor	Total (including washings)
Volume of effluent/tonne of hide/skins	6-9m ³	3-5m ³	1.5-1m ³	0.5-1m ³	1-2m ³	2-3m ³	3-6m ³	30-40m ³
pH	7.5-8.0	10.0-12.8	7.0-9.0	2.0-3.0	2.5-4.0	4.0-6.5	3.5-4.5	7.0-9.0
BOD 5 day at 20°C (Total)	1100-2500	5000-10000	1000-3000	400-700	350-800	800-1100	1000-2000	1200-3000
COD (Total)	3000-6000	10000-25000	2500-7000	1000-3000	1000-2500	2000-4500	2500-7000	2500-8000
Sulfides (as S)	-----	200-500	30-60	----	----	----	----	30-150
Total Solids (TS)	35000-55000	24000-48000	5000-12000	35000-70000	30000-60000	10000-14000	4000-9000	12000-23000
Total Dissolved Solids (TDS)	32000-48000	18000-30000	3000-8000	34000-67000	29000-57500	9000-12500	3600-8000	9000-18000
Suspended Solids (SS)	3000-7000	6000-18000	2000-4000	1000-3000	1000-2500	1000-1500	400-900	2000-5000
Chlorides (as Cl)	15000-30000	4000-8000	1000-2000	20000-30000	15000-25000	1500-2500	300-1000	6000-9500
Sulfate as SO ₄	800-1500	600-1200	2000-4000	12000-1000	12500-19000	1000-2000	1200-2500	1600-2500
Chromium (as Total Cr)	----	----	----	----	1500-4000	15-30	50-300	120-200

Table 1: Consumption Pattern of Chemicals in Leather Processing :

Chemical	Kg per Ton of Hide Substance	Global Consumption (In Thousand Tons)
Soaking aids	1.0-2.5	10.00
Preservatives	2.5-5.0	30.00
Lime	80-200	1300.00
Sodium sulphide	20-30	230.00
Ammonium salts	10-15	120.00
Sodium chloride	80-100	930.00
Sulphuric acid	12-20	150.00
Sodium formate	5-12.5	90.00
BCS	60-120	700.00
Al	1-20	5.00
Zr	0-15	2.00
Vegetable tannins	10-220	450.00
Synthetic tanning agents	20-60	200.00
Fatliquors	25-100	280.00
Dyes	2.5-20	28.00
Binders	20-45	90.00
Pigments	10-25	45.00
Top coats	20-45	20.00
Wax emulsions	2.5-5.0	25.00
Feel modifiers	1-2	10.00

Table 2 : Emerging Options in Making Leather Chemical Greener:

Leather Processing Stages	Conventional	Eco-Friendly Options	Advantages/Drawbacks
Curing	Sodium chloride	i. Chilling + biocide ii. Irradiation	Expensive : not always feasible
	Penta-Chlorophenol	i. TCMTB ii. OITZ	More expensive; anti-fungal and anti bacteria properties not present in one compound
Unhairing	Sodium sulphide	Proteolytic enzymes	Not fully effective for hides; not active below certain temperature
Deliming	Ammonium Chloride/ Sulphate	CO ₂	High affinity for lime; buffers in float; cost effective on higher operation scale
Degreasing	Alkyl phenyl/ epoxyates	i. Linear or branched epoxy-lates from oxo and fatty alcohols	Higher efficiency do not form persistent metabolotes
		ii. Lipase enzymes	Biodegradable
Pre-tanning	Basic chromium Sulphate	Aluminium tannage for wet white or white crust	Leather characteristics not yet comparable to chrome leather; poorer heat resistance
Tanning/ Retanning	Mineral tannage /retannage	i. Partial or total Cr. Replacement with Al, Zr, Ti, Fe	Leachability problems; economically less attractive

Leather Processing Stages	Conventional	Eco-Friendly Options	Advantages/Drawbacks
Fatliquoring	Chemical fillers	ii. Partial substitution with vegetable tanning (s) Compounds based on poultry feathers or animal	Biodegradable; promotes chrome exhaustion
	Synthetic fat liquors	Oleochemical based fat liquors	Less environmental damage
Finishing	Surfactants from petro-chemicals	Fatty acid oxylate based surfactants	Absence of phenolic constituents
	Cd and Pb chrome pigments	Organic alternatives	Covering power and light fastness deficiencies
	Nitrocellulose and lacquer emulsions	Water based pus	Poor flow properties; large quantity application
	Water proofing agents	Fluorinted acrylic co-polymers	Slower drying; oil and grease repellents
	Formaldehyde for casein fixation	Polyfunctional cross linking agents	Specific to protein materials; good rub fastness

TRADE WITH JAPAN GETS A DUTY-CUT BOOST

India's new trade agreement with Japan that seeks to more than double trade to \$25 billion by 2014 through duty cuts, came into force from 1st August 2011.

Under the deal, Tokyo has scrapped import duties on 87 per cent of the goods that it buys from India with immediate effect, while New Delhi has dropped tariffs on 17.4 per cent of its imports from Japan.

The comprehensive economic partnership agreement, signed in February, eventually seeks to abolish 94 per cent of bilateral tariffs within 10 years.

At present, trade with Japan stands at a little over \$12.6 billion.

Japan has removed almost all tariffs on industrial products, some agricultural items – such as mangoes, citrus fruits and spices – spirits, textiles, petrochemical and chemical products, cement and jewellery.

The import of Japanese consumer goods such as mobile phones – including SIM and memory cards – calculators, chargers, compact discs, DVDs and video cameras and textiles such as woven and silk fabrics will become duty-free.

Japanese cars will not be subject to concessional duties, but some of the imported car parts will be duty-free.

India will reduce duty on diesel engines to 5 per cent from 12.5 per cent within six years, while it will cut tariffs on gear boxes to 6.25 per cent from 12.5 per cent in eight years. Duties on car mufflers, which stand at 10 per cent, will be eliminated in 10 years.

Tokyo will not offer any concessions on rice, wheat, oil, milk, sugar, leather and leather products.

India has kept agricultural and some other items out of the tariff easing programme.

“We hope to get business opportunities in textiles, spices, most importantly pharmaceuticals and services. We will open our markets to auto parts and other goods from Japan,” commerce secretary Rahul Khullar said.

Japanese ambassador Akitaka Saiki said the business communities of the two countries should make the best use of this arrangement.

“This arrangement will definitely facilitate both ways flows of trade and investment,” he said.

- Telegraph

02.08.2011

CHINA POLICY MAY BOOST INDIAN EXPORTS

A shift in China's policy towards a consumer driven economy is expected to give an impetus to India's exports of garments, jewellery, small cars and engineering products to the neighbouring country, Parliament was informed.

"China's shift towards consumer-driven economy is likely to enhance exports of a consumer products from India," the Minister of State for Commerce and Industry, Mr. Jyotiraditya Scindia, said in a written reply to the Rajya Sabha.

India's trade deficit with China in 2010 stood at \$20.02 billion, more than \$15.87 billion registered in 2009. China has emerged as one of India's largest trading partners, with bilateral trade of \$61.74 billion in 2010 and is expected to reach \$100 billion by 2015.

- Asian Age
18.08.2011

EXPORTERS WANT DUTY ENTITLEMENT SCHEME EXTENDED

Exporters have appealed to the Government not to abolish the Duty Entitlement Pass Book (DEPB) scheme on September 30 and extend it till the Goods and Service Tax (GST) is implemented. Owing to the industry demand in June the Government had put off its plan to scrap the 14-year old DEPB scheme.

The DEPB is a reimbursement of basic and special customs duty paid by an exporter on an imported input used for producing the export product. The benefit is given by way of a grant of duty credit against the product exported at specified rates.

SECTORS BENEFITED

Mr. Harshad Bhayani, President, Indian Exporters Forum, said the DEPB scheme is extremely popular among exporters and covers about 52 per cent of exports. India's exports between April and July jumped 54 per cent to \$108.3 billion mainly due to good performance by petrochemical products, gems and jewellery and electronic goods.

Some major sectors that have benefited from the DEPB scheme are engineering products, chemicals, plastics, leather, sports goods, food products, handicrafts, electronics and textiles.

Apart from DEPB, other avenues for incentivising exporters include Duty Drawback Scheme and Advance Authorization Scheme. As the benefits under DEPB scheme are availed after completion of export obligation, there was no possibility of any misuse or litigation with Customs or Licensing Authorities, said Mr. Bhayani.

The Government wants exporters to switch completely to duty drawback scheme as some industries are benefited more than others in the DEPB scheme.

SMALL SCALE INDUSTRY

Manufacturers from small scale industry preferred DEPB as they do not import bulk quantity under Advance Authorization Scheme, while fixation of Duty Drawback Rate was time consuming and a lengthy process, hence, economically not viable in many cases. Small manufacturers could opt for indigenous material for their export product and still avail benefit of DEPB scheme, he said.

Mr. Nemish Sayani, former Chairman of Plastic Export Promotion Council, said given the uncertain global and domestic economic situation it is imperative for the Government to have a stable export incentive regime.

- Business Line

17.08.2011

PURIFY YOUR GLASS OF WATER BY SLIPPING A BANANA PEEL INTO IT

Banana peels, useful in polishing silverware and leather shoes, may have another surprising use- as a water purifier.

Gustavo Castro and colleagues said that minced banana peels performed better than a number of other purification materials in removing potentially toxic metal contamination from water.

Mining processes, runoff from farms and industrial wastes can all put health and environment harming heavy metals such as lead and copper into waterways.

Current methods of removing heavy metals from water are expensive, and some substances used in the process are toxic themselves. Previous work has shown that some plant wastes, such as coconut fibers and peanut shells, can remove these potential toxins from water.

They noted that a purification system made of banana peels can be used up to 11 times without losing its metal-binding properties.

- Deccan Herald

12.08.2011

PETA TO LAUNCH ‘PORN’ SITE TO DRAW ATTENTION TO ANIMALS

The People for the Ethical Treatment of Animals (PETA) is all set to draw the attention of millions of internet surfers when they launch their own ‘porn website’.

According to the Herald Sun, the animal rights group will use some obvious changes to internet domain names in order to register themselves to operate the www.peta.xxx website.

“We are preparing to launch our own peta.xxx site, but instead of just showing people our iconic ads we then show them how animals suffer for entertainment,” News.com.au quoted spokeswoman Ashley Byrne as saying.

“Our racier actions are sometimes a way to get people to sit up and pay attention to the plight of animals,” she said.

Initially, the watchers will be shown the animal rights groups too hot for TV ads and campaigns.

However, the sexy side Peta displayed in galleries and videos will quickly give way to the menacing world of animal mistreatment revealed by the group’s hidden camera investigations in a very different kind of graphic content.

- Times of India
22.08.2011

VIP SETS ITS SIGHT ON HANDBAG CATEGORY

The ₹ 758-crore VIP Industries is preparing to enter the handbag segment with a new brand by the year-end. The bags would be positioned as ‘mass premium’ and are likely to have a European sounding name. The company expects the bags will generate as much business as luggage within a decade.

Speaking to *Business Line*, Mr Dilip Piramal, Chairman, VIP Industries said, “We are planning to enter, the ladies handbag market by the last quarter and the full impact of this segment will only be visible next year. Though the handbag segment is nearly six to seven times the luggage market, there is still no big brand in it. We expect handbags to equal the luggage business in the next 10 years.”

Sourcing the ladies bags from China, like the rest of its luggage portfolio, VIP expects to build its indigenous brand in a relatively unorganized and unbranded bags market in India.

“Consumers need a choice and we felt there was potential in this category. Besides, handbags would complement our luggage business and we would use almost half our existing network of luggage dealers for the handbag category,” added Mr. Piramal.

Recently, VIP’s nearest competitor, Samsonite, also entered the bag segment with the Samsonite Red brand pegged upwards of Rs.2,500.

“We launched Samsonite Red in April this year and have positioned it as a unisex casual bag,” said Mr. Subrata Dutta, Managing Director, Samsonite.

Besides, there are also international bag brands such as Guess and Kipling, along with *desi* brands such as Hidesign and Holi (from the Future Group).

Meanwhile, with most international luggage majors suffering losses, VIP, which had a distribution tie-up with the ailing Delsey brand, is now replacing it with the Carlton brand, which it acquired nearly seven years back.

- Business Line
17.08.2011

LEATHER EXPORTS TO TOUCH \$5.4 BILLION BY 2014: ASSOCHAM

Despite slowdown in European economies, leather exports from India are likely to register a growth of 13 per cent and touch \$5.4 billion by 2014 from the current level of \$3.8 billion, according to an Associated Chambers of Commerce and Industry (Assocham) study.

The leather industry currently employs over three million workers. “With a strategy in place, the number of potential employees can rise by another 3 million in the next five years,” said Assocham.

India has a 3.5 per cent share in the global leather trade with the composition of exports changing, with more focus on value added products.

The major markets for Indian leather products are Germany with a share of 14.34 per cent followed by the UK (12.80 per cent) and Italy (11.52 per cent).

Export of different categories of footwear alone holds a major share of 45.05 per cent in India’s total leather products exports, with an export value of \$1732.04 million.

Among the categories which registered maximum growth in the last fiscal are leather footwear (37.98 per cent), leather goods (21.19 per cent), and finished leather (21.09 per cent).

-Business Line
New Delhi 27.08.2011

DUCKBACK REVIVAL PACKAGE

Bengal Waterproof Limited, popularly known for its Duckback brands products, which has been in the financial doldrums since late 2008 said that it was on the verge of finalizing a restructuring package to revive the company.

The company has submitted a restructuring proposal to the RBI corporate debt restructuring cell for an additional working capital to the tune of Rs.12 to Rs.13 crore, Mr. Abhishek Bose, whole time director of the company said.

The company has already received the preliminary approval and the final clearance is expected sometime during October or November this year, he said.

Rubbishing reports in a section of the media that the company was planning to shut shop, Mr. Bose said that there was no such intention of the management.

He said: "Some external forces accompanied by a few ex-employees of the company are trying to create commotion in the factory premises with the malign intention of grabbling the prime factory land at Panihati for real estate development." Bengal Waterproofs manufacturing unit at Panihati is spread over 20 acres of land adjacent to BT Road and it currently employees around 500 people.

The company has also sought the state government's assistance to overcome the difficulties. "We have been urging the government for the last two years for waiver of sales tax and statutory dues such as ESI and PF. We are yet to get any response," he said.

Duckback has laid down a strategy to expand its retail presence with a view to increase its sales volume. "Going forward, we will put more emphasis on increasing our retail sales rather than institutional sales," he said, adding the company plans to open an additional 30 exclusive retail outlets by 2013.

- Statesman
Kolkata, 31.08.2011

LIBERTY LOOKS TO GIVE SHOES SOME SHINE

Says it's not merely footwear but fashion-wear

Footwear brand Liberty Shoes, that recently roped in Bollywood actor Hrithik Roshan as its brand ambassador, plans to focus on three aspects of the Indian market. To increase the average selling price in the industry, to make footwear a fashion accessory and, therefore, move the shopping decision from a need-based purchase to an aspirational buy.

Mr. Anupam Bansal, Director, Liberty Group, said the average selling price of footwear at Liberty outlets now stands at ₹1,000- ₹1,200 for men, ₹500- ₹.600 for women and ₹200-300 for children.

“This is much higher than the average selling price in the industry, which is around ₹200 and we see huge potential for growth here.”

Apart from increasing the fashion quotient of the brand, Hrithik Roshan as a brand ambassador would also enhance Liberty’s youth connect, he added.

He said the average Indian male buys 1.1 pairs of footwear a year and women and children, three pairs a year.

Liberty Shoes, which has 350 exclusive outlets, stocks over 5,000 styles of shoes at any point of time.

The brand is also available in 6,000 multi-brand outlets across the country.

The ₹300-crore company has six plants manufacturing 60,000 pairs every day.

Over 20 per cent of the sales comes from the overseas markets.

The Indian footwear market is estimated to be around ₹ 2,000 crore, with 80 per cent in the unorganized sector.

- Business Line

19.08.2011

ANTI-DUMPING DUTY PROPOSED ON CHINESE PVC FLEX

The polyvinyl chloride (PVC) goods market may heave a sigh of relief, with a fall in demand and the consequent fall in prices recently.

Also, prices of leather goods such as upholstery, shoe, luggage, diaries, belts, jean labels and sports goods are likely to become a tad expensive due to the finance ministry’s decision to impose anti-dumping duty on imports of PVC flex films from China. Industry sources said imports of raw material PVC, a polymer variant, were free and demand for PVC flex goods was huge.

The Directorate General of Anti-Dumping & Allied Duties, in its final findings, has recommended anti-dumping duty may be imposed on imports of PVC paste, a variant of PVC, especially from China, Russia, Taiwan, Thailand, Korea and Malaysia. However, the finance ministry is yet to take a decision on this.

Given the current scenario, the finance ministry should act upon the recommendation to put anti-dumping duty on PVC resin (raw material) soon, market sources said. “Otherwise, the inverted duty structure may hamper the parent industry badly.”

PVC is the third-most used plastic or polymer petrochemical, after polyethylene and polypropylene. Depending on the manufacturing process or polymerization, there are two types of PVC. Suspension is plain or rigid PVC, used for construction works, while emulsion or paste PVC is used in coating and blending applications. PVC flex is an end-product, used in tarpaulins, canvas and printing. It is suitable for indoor and outdoor printing, used in billboard, display, banners and exhibition booth decoration and leather goods. The anti-dumping duty has been imposed for five years since July 2010.

Prices of PVC, the primary raw material for PVC films, remain sticky at ₹55,000-60,000 (basic variety) per metric tonne. Market sources are of the view that there is no point in putting anti-dumping duty on final products, when one can import cheap PVC resin for manufacturing PVC flex films. This will only make things difficult for the entire PVC market in India, since the price fall will continue. On the other hand, industry sources said producers of PVC flex films would get to raise their prices because of great demand and limited manufacturers.

- Business Standard
01.09.2011

FOOTWEAR & LEATHER FAIR 2012: 10-12 FEBRUARY 2012 – COLOMBO

Sri Lanka Export Development Board, No. 42, DHPL Building, Navam Mawatha, Colombo 2, Sri Lanka (Tel: 009411-2300726 Fax: 2303025, Email: infofff@edb.tradenetsl.lk website: www.lankaleather.lk) in association with the Ministry of Industry & Commerce of Sri Lanka is organizing its fourth Footwear & Leather Fair 2012 at the Bandaranaike Memorial International Conference Hall (BMICH), Colombo during 10-12 February 2012.

Sri Lanka produces wide range of modern shoes and the footwear exporters have already established themselves as suppliers of fashion footwear to well known international brands such as Marks & Spencer, Bata France, H. H. Browns, Clarks etc. One of the key advantages enjoyed by the footwear industry is the availability of high quality natural rubber including sole crepe. Sri Lanka also produces high quality leather goods and catering to the high end of the niche international brands like Play Boy Laurel, Helen Kaminski etc.

The organizers have limited the participation of foreign companies to the Footwear & Leather Fair 2012 for the suppliers of raw materials, machinery, components & accessories.

The Participation Fee is US\$500/- (inclusive of taxes). For further details and on-line registration, please visit www.lankaleather.lk

CHINA: FOOTWEAR EXPORTS INCREASE 22.9% IN APRIL

China's footwear exports reached \$11.9 billion for the month of April, up 22.9% year on year. The total exports value of the country set a record high in the same month.

In terms of exported areas, there was a 40% increase to Russia, Brazil and Indonesia while exports to EU and America maintain a steady growth at 30%.

STRONG FOUR-MONTH SHOWING FOR VIETNAMESE EXPORTS

Vietnam has estimated total export values of \$26.9 billion across all categories for the first four months of 2011.

Leather footwear and other leather goods had a share in the total of just over \$2.1 billion, compared to \$1.6 billion for the same four months in 2010, growth of 31% year on year. Footwear's share of the leather industry total was nearly \$1.75 billion, registering year-on-year growth in its own right of 28.5%.

During the month of April alone, exports of shoes from Vietnam earned \$430 million against \$350 million in the same month in 2010.

TREMENDOUS GROWTH FOR BANGLADESH

The Export Promotion Bureau (EPB) of Bangladesh has reported that the country's leather sector achieved export earnings of \$529.65 million between July 2010 and April 2011, the first ten months of the financial year. This represents a year-on-year increase of 47.5%.

Exports of finished leather over the ten-month period brought in revenues of \$238.76 million, an increase of 36.4%. Leather footwear increased from \$162.6 million to \$242.7 million, growth of 49.2% compared in the same ten months last financial year.

The government set the leather industry a target of \$563.8 million in export revenues for the full year.

- Indian Leather
June 2011

ANNOUNCEMENT

TRAINING COURSE IN UNDERSTANDING LEATHER AND LEATHER TRADE

A Three- day training course in Understanding Leather and Leather Trade. This training course is designed to cover areas like identification, assessment, selection and grading of leather, and provide an opportunity to share knowledge and expertise needed for better appreciation, care and maintenance of leather and leather products. The programme will also provide an update on health, hygiene, safety and other environmental issues concerning the leather products manufacturing industry and present an overview of leather industry to have a better understanding and appreciation of the global nature of leather trade and its implications.

This course is primarily aimed at those working in purchase, store, production, leather grading/selection/appraisal and quality control sections of leather goods manufacturing units. It is suitable also for those who are involved in marketing, sourcing, trading and retailing of leather and leather products. This three days intensive/comprehensive leather course is intended to provide them with essential knowledge of this unique material. This programme will give them the confidence to identify and select the right kind of leather for intended products, utilize the material in proper manner for fabrication of articles, and store and handle the articles with necessary care without errors. This course is expected to broaden their view of world leather market so as to excite them to explore it further.

Regional Centre for Extension and Development of CLRI will organize this programme with support from Entrepreneur Development Institute of India (EDI), Ahmedabad. The programme will be held at Kolkata during October 12 to October 14, 2011.

Those interested in joining this course may kindly contact:

**Regional Centre for Extension and Development
(Central Leather Research Institute),
3/1C, Matheswartala Road, Kolkata 700046.
Tel: 033-23292381, Fax: +91 33-23296046
Email: rcedcal@bsnl.in; dipankar.clri@gmail.com**

ANNOUNCEMENT

LEATHER SCIENCE ABSTRACTS

VOLUME 44

NUMBER 9

SEPTEMBER 2011



NATIONAL INFORMATION CENTER FOR LEATHER & ALLIED INDUSTRIES (NICLAI)
NATIONAL INFORMATION SYSTEM FOR SCIENCE & TECHNOLOGY (NISSAT)

CENTRAL LEATHER RESEARCH INSTITUTE

ADYAR, CHENNAI 600 020, INDIA

Leather Science Abstracts (**LESA**) is published by National Information Center for Leather and Allied Industries (**NICLAI**), Central Leather Research Institute (**CLRI**), Chennai.

It is a monthly abstracting periodical covering significant papers/articles published in the fields of Leather Science and Technology, Footwear Technology, Leatherware and Leathergoods, Leather chemicals, Leather machinery, Leather economics etc., appearing in about 500 scientific and technical periodicals published all over the world. The abstracts are presented under well defined subject headings and include indexes.

All enquiries for further details should be addressed to THE DIRECTOR, (**ATTN.: EDITOR, LESA**) CENTRAL LEATHER RESEARCH INSTITUTE, ADYAR, CHENNAI-600 020, INDIA.

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LEATHER SCIENCE AND TECHNOLOGY

LEATHER INDUSTRY. HISTORY. MANAGEMENT. ECONOMICS. EDUCATION

44.10341

Practice-related research methods as part of scientific information systems research. HALONEN (R), (Center for Innovation & Structural Change (CSIC), National University of Ireland, J.E. Cairnes School of Business and Economics, Galway, Ireland & Department of Information Processing Science, P.O. Box 3000, 890014, University of Oulu, Finland). (Indian J. Sci. Technol.; 2, 5-6; 2009, May-Jun.; 75-81).

The importance, of research methods in science information systems research, is discussed. Practice-driven research methods are emphasized for limiting this approach. While the nature of 'research' is dependent on research approach, quantitative research is focused. Additionally, research methods are not focused but their role in scientific research. Prior literature also reveals that qualitative research and quantitative research are not exclusive; instead often the approaches are complimentary. Three examples of how research methods were used and how they influenced the output were introduced. (25 Ref.; 3 Fig).

44.10342

Chemical databases : A review. TANEJA (S), SATBIR JAIN, AJAY KUMAR, (Netaji Subhash Institute of Technology, Azad Hind Fauz Marg, Sector 3, Dwarka, New Delhi – 110 078, India). (Chem. Wkly.; 54, 42; 2009, Jun., 2; 201-5).

The general features, of chemical databases and some important chemical databases, are described. (8 Ref.; 3 Photos).

44.10343

Simplified management for SMEs : The 6Ms approach. GHARPURE (YH), (Chem. Wkly.; 54, 39; 2009, May, 12; 195-8).

An effort, that has been made for boiling down the basic principles of Management under the heads such as (a) Men Management; (b) Materials Management; (c) Machines Management at factory level; (d) Marketing Management; (e) Money Management and (f) Methods Management at head office and also an effort, that has been made for distilling the various theories and techniques of management under the above 6Ms, in an understanding language for Small and Medium Enterprises(SMEs) to benefit, have been described. The rise, of modern management, is discussed. (1 Tab.; 1 Fig.).

44.10344

Global fertilizer outlook and challenges facing manufacturers in India. SUKUMARAN NAIR (MP), (Chemical Engineering Division Board, Institution of Engineers (India), Delhi State Center, ENGINEERS BHAWAN, 2 Bahadur Shah Zafar Marg, New Delhi – 110 002, India). (Chem. Wkly.; 54, 38; 2009, May, 5; 203-7).

The developments, progresses and opportunities, that have been made so far by the fertilizer industry in the universe with special reference to India and the challenges, that are currently facing by the Indian manufacturers are discussed. The prospects for the fertilizer industry in the country, growth in the 1980s and the decline of the industry in 1990s as well as new policy, that is intended to be implemented by the government of India are also discussed. The importance, of focusing by the manufacturers on coal and the availability of the natural gas, are described. Few options, for the development of this industry are given. (2 Photos).

44.10345

Winning strategies in a recession. PANT (P), (Marketing Department, M/s. Colorband Dyestuffs Private Limited, Registered Office, No. : 7/7 Tardeo A/c Market Building, Tardeo Main Road, Mumbai – 400 034, India). (Colourage; 56, 5; 2009, May; 56-7).

A smart company must have to take up few very drastic steps to confront the various challenges and emerge a winner. These drastic steps have been listed. Few factors, that very much affect the economic progress and create the recession in the business ventures that automatically affect the economic properties of any nation are briefly discussed.

44.10346

All dressed up for the European markets. (Leathers; 25, 5; 2009, May; 22-3).

It is very strongly pointed out that any producer who is regularly exports his or her products to the European Union(EU), should have to be aware of at least the EU's legal requirements, while knowing about additional buyer requirements which may certainly open up new market opportunities. Center for the Promotion of Imports from developing countries(CPI) have defined market access requirements(MARs) as all legal requirements and additional buyer requirements that producers face when marketing their products in the EU. Naturally, some buyer requirements may go beyond legal requirements, for instance if the buyer focuses on a niche market such as organic or fair trade. Labour conditions are another example of an issue that may be of importance.

44.10347

Consequences of the implementation of REACH on the tanning industry. (Leathers; 25, 5;2009, May; 23-4).

The effects, that are likely to be made by REACH on the tanning industry in general and specifically on the business ventures. The still evolvement of the regulations and the response of the requirements of REACH has made the impossibility of exactly knowing the consequences of REACH on all fields in the industry. This release is however intended to provide some informed opinion on likely consequences for manufacturers of leather. The effects of REACH will be felt by everyone who is involved in Europe and will most likely affect parts of the supply chain that are not directly involved in Europe because of the global nature of leather manufacturer and tannery suppliers. The responsibility of the downstream user such as the leather manu-

facturer or tanner, is to ensure that their suppliers are complying with REACH regulations. Even though, the downstream users are generally exempted under REACH regulations, they must have to be aware of certain special circumstances. Tanners should have to take few steps to operate their business ventures from or for the European Market.

44.10348

E-business system development : review on methods, design factors, techniques and tools with an extensive study for secure online retail selling industry. SAINI (H), SAINI (D), GUPTA (N), (Department of Information Technology, Orissa Engineering College, Bhubaneswar – 752 050, Orissa State, India). (India J. Sci. Technol.; 2, 5-6; 2009, May-Jun.; 82-91).

The potential of the internet economy demands newer business models and all-round information systems. The cross-enterprise business process requires high co-ordination of the customers and the suppliers, taking less time and high outcomes. The companies, that are involving in a painstaking process of designing its information systems for future development, for exploiting this potential of the internet economy. A variety of techniques available to implement the e-commerce includes EDI, electronic markets and internet e-business. These techniques are implemented using various technologies like WAP, Bluetooth, Mobile computing and many others. Developer tools are required to implement the technologies includes various web tools like J2EE, ASP, Visual Basic, WAP(WML/WSL), DHTML, C++, Powerbuilder, Informix/4GL. It also involves web/application servers like commerce server by Microsoft, Allaire J Run, IBM websphere and Integration platforms like Microsoft Biztalk servers, Data Junction adapters, EAI etc. A case study is given for the Secure Online Retail Selling Industry which represents how a traditional selling system can convert itself into e-business system with a better performance. (10 Ref.; 7 Fig.).

44.10349

The role of collective bodies in protection of intellectual property rights in India. BHAT (PI), (Department of Studies in Law, University of Mysore, Manasagangotri, Mysore – 570 006, Karnataka State, India).(J. Intellect. Proper. Right.; 14, 3; 2009, May; 214-25).

The communitarian dimension of Intellectual property rights (IPRs) calls for use of collective effort of knowledge workers in the IPR enforcement and non-exploitation of IPR owners and consumers. Collective bodies (CBs), like copyright societies, patent tools, Geographical indications (GI) associations, etc. function as social economy entities in rendering the task cheap, effective and fair. The IPR, like farmers' rights, collective marks and geographical indications involve definite collective intellect that can be better protected by CBs. Indian profile about CBs needs to be strengthened for effective enforcement of IPR, fair resolution of community claims and advancement of knowledge. Indian law has some orientation against possible dominant position or abuse by CBs but needs clear policies and mechanisms in order to suit the requirement of constitutional goals. Unless legal environment governing these CBs guides them in the path of a good governance and fair consequence avoiding the exploitation of members and consumers, the interests of knowledge society would suffer.

The Indian IP laws policy on CBS's role in protection of IPR, their working and their impact is examined. Whether the suitability, of the regime to resolve the conflict of interests between different sections of the society and the attainment of justice; the possession of the reliable democratic structure and policy thrust to ensure transparency and accountability with themselves; whether the claims of members and society vis-à-vis the organization are adequately protected; are enquired. A doctrinal legal research on the topic is done.(31 Ref.).

44.10350

Patentability of plants : Technical and legal aspects. PARVIN (MR), (Agricultural Biotechnology Research Institute of Iran(ABRII), Intellectual Property Rights Department, Seed and Plant Institute's Campus, Mahdasht Road, PO Box 31535-1897, Karaj, Iran). (J. Intellect. Proper. Right.;14, 3; 2009, May; 203-13).

According to Article 27.3(b) of the Trade-Related Aspects of Intellectual Property Rights (TRIPS) Agreement, Members may exclude 'plants' from patentability, but they shall provide for the protection of 'plant varieties' either by patent or by an effective sui generis system or by any combination thereof. While the patentability of plants, is focused, alternative protection system(Breeder's right as a sui generis system) has not been ignored. There may be some overlap between these protection systems which need careful consideration. In view of the importance of the decision of countries to protect plant varieties, the possibilities of the current patent laws and legal positions adopted by jurisprudence or doctrine particularly in the field of transgenic and hybrid plants are also both overviewed and assessed. (52 Ref.).

44.10351

Does biotechnology/nanotechnology patenting promotes science or profits? ZEKOS (GI),(ICFAI Univ. J. Intellect. Proper. Right.; 8, 2; 2009, May; 7-25).

On par with the advancements in the information technology fields, the technologies have entered in the field of biological and genetic material area and renaming it as biotechnology. The advanced and continuance research in the field are blurring the distinctiveness between the inventions and discoveries. The concept of molecular nanotechnology is further adding to the new knowledge to it. A number of applications are filed to capture the patents for the new invented knowledge. New breeding techniques from the core area of such inventions. The difficulty, of distinguishing the filing of applications between the process and product patents in this area, is explained. The design and draft of new conventions and treaties in order to strengthen the protection to such conventions, are described. It is viewed that there is a need to plug the gray areas to check exploitation of real inventions in the name of invention for merchandise purposes. (137 Ref.).

44.10352

IP case law developments. THOMAS (Z), (Open Source Drug Discovery(OSDD) & Director General (DG)'s Cell, Council of Scientific and Industrial Research(CSIR), Anusandhan Bhawan, 2 Rafi Marg, New Delhi – 110 001, India). (J. Intellect. Proper. Right.; 14, 3; 2009, May; 247-57).

A summary, of some of the recently reported cases on intellectual property law, is attempted to enable the readers to understand how the courts have applied the principle of intellectual property law to actual IP disputes. Widely discussed cases, on trademark law, copyright law and patent law are covered. (5 Ref.).

44.10353

Computer program patents and the law and policy of patent eligible subject matter : The creation of a private social contract? LEE (N), (Faculty of Law, Business Administration and Economics, Joensuu University, Post Office Box 111, FI-80101, Joensuu, Finland). (ICFAI Univ. J. Intellect. Proper. Right.; 8, 2; 2009, May; 26-37).

A patent is granted on the assumption that the grant of a right achieves or works towards achieving the policy goals. As patent law incorporates two contrasting policies among others, some area of patent law seem to reflect more of exclusion and while others may seem to be reflecting more of diffusion and shape the direction of legal change. Some of the law and policy questions, in the development of patentable subject matter rules in Europe, Japan and the United States, are reviewed and any limiting principle, for the patentable subject matter that seems to be highly fact based on the claims of the patent, is noted. It is claimed that when the Courts and praxis of the patent offices base their interpretation of law on how claims are written, indirectly the patent claims are used as a policy tool and such use may have further implications on other policy dimension of patent law. (32 Ref.).

44.10354

Establishing a safeguard system for intellectual property protection for private enterprises. LIU (W), (Department of Social Science, Zhejiang Shuren University, No. 19, Zhoushan East Road, Hangzhou 310 015, China). (J. Intellect. Proper. Right.; 14, 3; 2009, May; 226-35).

Chinese private enterprises have created substantial wealth in the recent years; as a result, private sector has been an important component of Chinese economy. The expedited globalization and informationalization presents some challenges to Chinese private enterprises in the regime of intellectual property(IP) protection and management. As for many commercial activities, such as foreign trends, investment, merger and acquisition, IP may be of central concern for all the participants; therefore to some extent, IP is always regarded as a crucial matter to enterprises' survival and development. However, Chinese private enterprises seemly have not fully prepared for establishing a safeguard system for IP to date. The problems and troubles, that Chinese private enterprises have encountered in the regime of IP protection, which exist in legislation, enforcement and enterprise's management systems, are explored first. The elements, that impede the progress of upgrading IP protection system, are analysed. Finally, some suggestions for helping private enterprises to improve their level of IP protection respectively from the view of enterprises, IP agents, government and local authorities, are proposed. (20 Ref.; 3 Tab.).

44.10355

Engineering education in leather : A case study. SADULLA (S), (M/s. Indian Shoe Federation, Third Floor, Chennai Metropolitan Development Authority Tower, Gandhi-Irwin Road, Near Albert Cinema Hall, Egmore-600 008, India). (Indian Leather; 43, 4; 2009, Jun.; 33-44).

Leather making might be the world's oldest manufacturing activity. Thus, it is the world's oldest industry. Tanning Technology – the process of converting hides and skins might also be the world's first technology ever perfected. As contrasted to science, which is generic and does not call for referencing to the social priorities of the immediate society, technology is more closely linked to the socio-economy. Leather is an important economic commodity and provides export potential for many developing countries. A need, for adding value to leather through technology and improvements in quality of products, is stressed very strongly in order that the full economic and export potentials are utilized from the leather industry. The man behind the machine holds the key to the success of any industrial sector. The role of this important resource-human resource in the context of Indian leather is critically analyzed and the paraphrasing of the leather technology education to the needs of the immediate consumer/society(tanning industry) through a close interface with economy and the public policy of the nation is reviewed. A case, for an effective partnership of academy/research and industry for engineering and technological education, is made. (8 Ref.).

RAW HIDE AND SKINS

44.10356

Characterization of embryonic stem cells : A special focus on farm animals. KUMAR (D), ANAND (T), SINGH (MK), CHAUHAN (MS), MANIK (RS), (Animal Biotechnology Center, National Dairy Research Institute (Deemed University), Kanal-132 001, Himachal Pradesh State, India). (Indian J. Biotechnol.; 8, 1; 2009, Jan.; 23-32).

Embryonic stem(ES) cells are derived from the inner cell mass of blastocysts. They grow indefinitely while maintaining the pluripotency in the presence of specific growth factors such as leukemia inhibitory factor. The molecular mechanisms for self-removal of pluripotent cells and the role of various growth factors involved in self-removal as well as differentiation are being deciphered. ES cells, in their undifferentiated state, are characterized by a distinct morphology and by the presence of a set of markers classified into intracellular and extracellular types. Expression of surface and transcription based specific markers, is an important criteria for pluripotent or undifferentiated state of cells. The expression of these markers is found to be exclusive to a particular species. A thorough understanding of the expression of these markers and of factors or conditions for the long-term culture of ES cells, without compromising their pluripotency and a stable genetic make-up is very important for the production and maintenance of ES cells from different species of farm animals. The characterization, of embryonic stem cells in farm animals is overviewed. (114 Ref.; 4 Tab.).

44.10357

Genetic variation and differentiation in the Stinging catfish, *Heteropneustes fossilis*(Bloch), populations assessed by Heterologous microsatellite DNA markers. NASREN (S), NAZRUL ISLAM (M), QUADER KHAN (MG), SHAHIDUL ISLAM (M), SAMSUL ALAM (Md), (Department of Fisheries Biology and Genetics, Bangladesh Agricultural University, Mymensingh 2202, Bangladesh). (Indian J. Biotechnol.; 8, 1; 2009, Jan.; 85-90).

Microsatellite deoxyribonucleo acid (DNA) have been increasingly used in genetic diversity studies. The characterization, of genetic variation and differentiation in four different natural populations of the stinging catfish, *Heteropneustes fossilis*(Bloch), in Bangladesh, viz., Mymensingh, Netrakona, Narsingdi and Rangpur, using cross-species microsatellite DNA markers developed from the walking catfish, *Clarias batrachus*. Eighteen polymorphic alleles were found in the 128 diploid individuals(32 from each population), with nine alleles at each of the two loci analyzed. The Netrakona and Rangpur population deviated from the Hardy-Weinberg proportion at one locus. The population differentiation(F_{ST}) value between the Narsingdi and Netrakona population was found to be insignificant, while the values between all the other population pairs were found to be significant. The genetic distance values ranged between 0.165 and 0.626. The UPGMA dendrogram based on genetic distance resulted in two clusters namely the Mymensingh population was in one cluster and the three other populations in the second cluster. A fairly high level of genetic variation in the microsatellite loci within and between the four populations and identified existence of distinct population groups of *Heteropneustes fossilis*. (23 Ref.; 2 Tab.; 2 Fig.).

44.10358

Propoxur-induced acetylcholine esterase inhibition and impairment of cognitive function : Attenuation by *Withania somnifera*. YADAV (CS), KUMAR (V), SUKE (SG), AHMED (RS), MEDIRATTA (PK), BANERJEE (BD), (Environmental Biochemistry and Molecular Biology Laboratory, Department of Biochemistry, University College of Medical Sciences and GTB Hospital, University of Delhi, Dilshad Garden, New Delhi – 110 095, India). (Indian J. Biochem. Biophys.; 47, 2; 2010, Apr.; 117-20).

Propoxur-(2-isopropoxyphenyl N-methylcarbamate) is widely used as an acaricide in agriculture and public health programs. Studies have shown that sub-chromic exposure to propoxur can cause oxidative stress and immune-suppression in rats. Carbamates are also known to exhibit inhibitory effect on cholinesterase activity, which is directly related to their cholinergic effects. The effect of *Withania somnifera*(Ashwagandha), a modulatory properties was studied on propoxur-induced acetylcholine esterase inhibition and impairment of cognitive function in rats. Male Wistar rats were divided into four groups. Group **I** was treated with olive oil and served as control. Group **II** was administered orally with propoxur(10 mg/kg body weight) in olive oil, group **III** received a combination of propoxur (10 mg/kg body weight) and *Withania somnifera*(100 mg/kg body weight) suspension and group **IV** *Withania somnifera*(100 mg/kg body weight) only. All animals were treated for 30 days. Cognitive behavior was assessed by transfer latency using elevated plus maze. Blood and brain acetylcholine esterase (*AChE*) activity was also assessed. Oral administration of propoxur(10 mg/kg body weight) resulted in a significant reduction of brain and blood *AChE* activity. A significant prolongation of the acquisition as well as retention transfer latency was observed in propoxur-treated rats. Oral treatment of *Withania somnifera* exerts protective effect and attenuates *AChE* inhibition and cognitive impairment caused by sub-chromic exposure to propoxur. (22 Ref.; 3 Fig.).

44.10359

Probable mechanism(s) of antifungal activity of HA-2-91—A tetraene antibiotic. NAIR (SR), GUPTE (TE), (Research and Development Center, M/s. Hindustan Antibiotics Limited, Pimpri, Pune – 411 018, Maharashtra State, India). (Indian J. Biotechnol.; 8, 1; 2009, Jun.; 91-6).

HA-2—91(a tetraene antibiotic) is produced by *Streptomyces arenae* var. ukrainiana and shown to elicit anti-fungal activity(in vitro) against yeasts and filamentous fungi including plant pathogens and clinical isolates. Experimental studies were carried out by using both biological as well as chemical methods to understand the probable mechanism(s) : of antifungal action of HA-2—91. Experimental findings suggest that HA-2—91 binds to both ergosterol and cholesterol present on the fungal and mammalian cell membranes. However, results showed preferential binding of HA-2—91 towards ergosterol than cholesterol. Further, the interactions(bindings of HA-2—91 with membrane sterols) seem to be reversible process. The effect will be greater on fungal cell membrane than mammalian cell membrane with such preferential degree of binding of HA-2—91. Hence, adverse reactions like haemolysis may not occur. (21 Ref.; 2 Tab.; 7 Fig.).

PROTEINS AND COLLAGEN

44.10360

Genotype analysis and assessment of antigenic sensitivity for recombinant HCV proteins by indigenous SIBA for detection of Hepatitis C Virus infection : A comparison with 3rd EIA and RT-PCR. PONAMGI (SPD), CHANDRA (M), NARESH KUMAR (Y), RAHAMATHULLA (S), NARASU (L), HABIBULLAH (CM), KHAJA (MN), (Center for Liver Research and Diagnostics, Deccan College of Medical Sciences and Allied Hospitals, Kanchanbagh, Hyderabad – 500 058, Andhra Pradesh State, India). (Indian J. Biotechnol.; 8, 1; 2009, Jan.; 33-9).

The first serological testing for the detection of anti-Hepatitis C virus(HCV) antibodies using recombinant antigens was introduced in 1991. Since then many developments have taken place and at present third generation ELISA kits are being used most widely and globally. Detection of anti-HCV does not distinguish past from present infections and in diagnostic virology particularly ELISA's, a positive HCV test result may be non-specific and therefore has to be crosschecked by another test of different principle for which Immunoblots were initially developed. Patients with liver disease attending the inpatient and out-patient wards of the Center for Liver Research and Diagnostics(CLRD) between August 2004 and February 2007 were screened for HCV by using 3rd generation ELISA, HCV blot and RT-PCR. Genotyping was done for all the positive samples. Out of 531 samples tested, 211 samples showed identical results as reactive by ELISA, HCV blot and RT-PCR. Out of the 214 genotype samples, genotype 1a was found to be prevalent by 52-33%(n=112), followed by others. Ribonucleic acid(RNA) based detection by RT-PCR remains the reliable method of HCV diagnosis, however, where there are no facilities for the PCR to be performed particularly in the small to medium laboratory and diagnostic centers, HCV blot could be done as a supplementary assay. (40 Ref.; 4 Tab.; 3 Fig.).

ENZYMOLGY

44.10361

Assembly of recombinant coat protein of sugarcane streak mosaic virus into polyvirus-like particles. HEMA (M), SUBBA REDDY (ChV), SAVITHRI (HS), SREENIVASULU (P), (Department of Virology, College of Biologi-

cal and Earth Sciences, Sri Venkateswara University, Tirupati – 517 502, Andhra Pradesh State, India). (Indian J. Exp. Biol.; 46, 11; 2008, Nov.; 793-6).

The expression, of coat protein (CP) gene of sugarcane streak mosaic virus-AP isolate (SCSMV-AP) in *Escherichia coli* and the purification, of the recombinant CP(SCSWP-AP rCP) by linear sucrose density gradient centrifugation, are described. An observation, of the purified SCSMV-AP rCP under electron microscope, revealed the presence of polyvirus-like particles (PVLPS). The assembled particles had been shown to encapsidate CP gene transcripts by slot-blot hybridization. (26 Ref.; 5 Fig.).

44.10362

Microbial biotechnology – Rapid Advances in an area of massive impact. RAJASEKARAN (R), CHANDRASEKARAN (R), MUTHUSELVAM (M), (Post-Graduate and Research Department of Botany and Microbiology, A. Veeniya Vandayar Memorial Sri Pushpam College(Autonomous), Kudikadu, Poondi – 613 503, Thanjavur District, Tamil Nadu State, India). (Adv. BioTech; 7, 6; 2008, Dec.; 19-25).

Some of the promising areas of research and development in the field of microbial biotechnology which is utilized for enzymes, organic acids, antibiotics, drugs and pharmaceuticals, are described. (16 Ref.; 2 Tab.; 1 Fig.).

44.10363

Changes in some biochemical parameters in the liver and muscle of *Colisa fasciatus* due to toxicity of ethanolic extract of *Nerium indicum Mill.* (Lal Kaner) latex. TIWARI (S), AJAY SINGH. (Department of Zoology, Deen Dayal Upadhaya(DDU) Gorakhpur University, Gorakhpur – 273 009, Uttar Pradesh State, India). (Nat. Prod. Rad.; 8, 1; 2009, Jan.-Feb.; 48-54).

The piscicidal toxicological and biochemical effects of ethanolic extract of *Nerium indicum Mill.*(Lal Kaner) latex against fresh water weed fish *Colisa fasciatus* were dealt. There was a significant($P<0.050$) negative correlation between lethal concentration(LC) values and exposure periods i.e.LC50 values decreased from 14.05 mg/l(24 hours) to 5.52 mg/l/96 hours). Sub-lethal exposure of ethanolic latex extract for 24 hours and 96 hours caused significant ($P<0.05$) time and dose dependent alterations in the levels of total protein, total free amino acid, nucleic acid, glycogen, pyruvate, lactate and also in the activity of enzyme protease, alanine aminotransferase, aspartate aminotransferase, acetylcholinesterase, lactic dehydrogenase, succinic dehydrogenase and cytochrome oxidase in liver and muscle tissues of fish. Withdrawal experiments shows, their biochemical effects are reversible in action. Thus, *Nerium indicum* latex extract mainly suppress energy production and shifts fish respiration towards the anaerobic segment. (36 Ref.; 2 Tab.; 1 Fig).

44.10364

Estimating the distribution of forms of cytochrome oxidase from the kinetics of cyanamide binding. BROWN (S), (Biochemistry Department, School of Life Sciences, University of Tasmania, Locked Bag 1372, Launceston, Tasmania 7250, Australia). (ICFAI Univ. J. Biotechnol.; 2, 4; 2008, Dec.; 51-60).

Cytochrome oxidase preparations are heterogeneous, so ligand binding to the purified enzyme is multiphasic. The usual strategy when analyzing cyanide binding kinetics is to fit a multiexponential expression to the progress curve. However, a more satisfying approach is to fit a stretched exponential function from which the distribution of the rate constants can be estimated. The multifunctional function, rather than the stretched exponential, is barely justified as best for use, is shown by analyzing the data in which a preparation of the 'fast' cyanide binding cytochrome oxidase is converted to the 'slow' form of enzyme. Moreover, the stretched exponential approach shows that the relatively narrow, almost normal distribution of small time constants (δ) observed with the 'fast' form of the enzyme becomes a broad, long-tailed distribution in the 'slow' form of the enzyme. The enzyme heterogeneity inferred from the multiexponential model can be characterized unambiguously using the stretched exponential model. (22 Ref.; 2 Tab.; 4 Fig.).

44.10365

FRET between non-substrate probes detects lateral lipid domain formation during phospholipase A_2 interfacial catalysis. VALLEJO (AA), FERNANDEZ (MS), (Department of Biochemistry, Centro de Investigacion y de Estudios Avanzados, del I. P. N.(CINVESTAV), P.O. Box 14.740, 07000 Mexico D.F., Mexico). (Arch. Biochem. Biophys.; 480, 1; 2008, Dec., 1; 1-10).

An application, of a fluorescence resonance energy transfer(FRET) approach for detecting lipid bilayer microheterogeneities that may arise as a consequence of phospholipase A_2 activity is aimed. It is investigated in particular whether or not the activity of phospholipase A_2 on liposomes affects the intermolecular FRET between two non-substrate fluorescent probes inserted in the lipid vesicles. The change, in fluorescence of C_{12} -NBD-FA(12-[(7-nitrobenz-2-oxa-1,3-diazol-4-yl)amino]) dodecanoic acid) in the presence of C_{18} -R(octadecyl rhodamine B chloride), is focused. The rationale is that FRET between those two monitors could be perturbed as a result hydrolysis. No direct effect, of the catalytic process on the fluorophores, since neither of the two is a substrate for the enzyme, is found. Therefore, any variation in FRET efficiency that might appear during the enzymatic action should be attributed to a secondary effect of the hydrolysis. (65 Ref.; 22 Fig.).

44.10366

The structure of urease activation complexes examined by flexibility analysis, mutagenesis and small-scale X-ray scattering. QUIROZ-VALENZUELA (S), SUKURU (SCK), HAUSINGER (RP), KUHN (LA), HELLER (WT), (Department of Microbiology & Molecular Genetics, Michigan State University, 2215 Biomedical Physical Sciences, East Lansing, Michigan 48824-4320, USA). (Arch. Biochem. Biophys.; 480, 1; 2008, Dec., 1; 51-7).

Conformational changes of *Klebsiella aerogenes urease* apoprotein(UreABC)₃ induced binding of the UreB and UreF accessory proteins had been examined by a combination of flexibility analysis, mutagenesis and small-angle X-ray scattering(SAXS). ProFlex analysis of urease provided evidence that the major domain of UreB can move in a hinge-like motion to account for prior chemical cross-linking results. Rigidification of the UreB hinge region, accomplished through a G11P mutation, reduced the extent of urease activation, in part by decreasing the nickel content of the mutant enzyme and by sequestering a portion of the urease apoprotein in a novel activation complex that includes all of the accessory proteins. SAXS analyses of urease, (UreABC-

UreD)₃ and (UreABC-UreDF)₃ confirm that UreD and UreF bind near UreB at the periphery of the (UreAC)₃ structure. An activation model, in which a domain-shifted UreB confirmation in (UreABC-UreDF)₃ allows carbondioxide(CO₂) and nickel to gain access to the nascent active site, is supported. (45 Ref.; 7 Fig.).

44.10367

Enhanced production of cellulose protein on mixture of xylose, lactose, cellulose and sugarcane leaf using *Trichoderma reesei* 992 6a. BHARATHI RAJA (B), AYYAPPASAMY (S), SANTHOSH KAILASH (R), (Department of Biotechnology, Arunai Engineering College, Velu Nagar, Mathur, Thiruvannamalai – 606 603, Thiruvannamalai-Sambuvarayar District, Tamil Nadu State, India). (Adv. BioTech.; 8, 7; 2009, Jan.; 26-30).

Cellulase production on the mixture of xylose, lactose and cellulose was studied and compared to the natural source(sugarcane leaf) by the strain *Trichoderma reesei* 992 6a. The experiment was conducted on single substrate ie. xylose, lactose, cellulose and the combination of these three substrates. The sugarcane leaf was used as another substrate. The combination of the three substrates produced highest cellulose activity and reached the maximum protein than others when compared to the other individual substrates and source(sugarcane leaf). A Triaxic pattern of utilization of three carbon sources was observed as well as compared to the single and natural carbon sources. Xylose and lactose was utilized first to support growth followed by cellulose to induce the cellulose enzyme production. The mixture of xylose, lactose and cellulose used in batch enzyme production. This mixture produced the highest maximal cellulose activity of 6.4 IFPU/ml in same time than others. (18 Ref.; 6 Tab.; 10 Fig.).

44.10368

Characterization of thermoalkalophilic xylanase isolated from *Enterobacter* isolates. SHARMA (A), PUJARI (P), PATEL (P), (Bacteriology Laboratory, Department of Post Graduate Studies and Research in Biological Sciences, Rani Durgavati Viswavidhyalaya University, Saraswati Vihar, Pachpedi, Jabalpur – 482 001, Madhya Pradesh State, India). (Indian J. Biotechnol.; 8, 1; 2009, Jan.; 110-4).

Thermoalkalophilic xylanase was isolated from *Enterobacter* spp. with significant activity. Maximum enzyme activity was observed in isolate BGCC#259(*Enterobacter cloacae*), ie. 0.056 IU/mL in 24 hours, while the highest biomass was observed at 36 hours of incubation. Hydrolysis study revealed complete degradation of xylan to xylose after 12 hours of incubation. The molecular mass of the xylanase was ~43kDa. The enzyme was characterized at varied range of pH and temperature and it was found that all five *Enterobacter* isolates had a pH and temperature optima of 8.0 and 80°Centigrade, respectively. At 80°Centigrade, xylanase from isolate BGCC#254(*Enterobacter cloacae*) retained 100% activity, while BGCC#259 retained more than 90% activity after 24 hours. (20 Ref.; 9 Fig.).

44.10369

Biocides. SIVARAMAKRISHNAN (CN), (Colourage; 55, 11; 2008, Nov.; 40-1).

The general uses, of biocides for killing or inhibiting the growth of living organisms in industrial and consumer products, are described. Five classes, of biocides are listed. The major applications, of specialty biocides including inks and coatings, metal working fluids, adhesives and emulsions, plastics, paints and surfactants as well as oil field and water treatment systems are listed. The biocides technology options for various industrial applications are also listed and two of the options namely glutaraldehyde and enzyme technologies are briefly described. The advantages of this technology are also briefly described.

44.10370

An integrated biodesulfurization process, including inoculum preparation, desulfurization and sulfate removal in a single step, for removing sulfur from oils. TANGAROMSUK (J), BOROLE (AP), KRUA TRACHUE (M), POKETHITIYOOK (P), (BioSciences Division, Oak Ridge National Laboratory P.O. Box 2008, Oak Ridge, Tennessee 37831-6442, USA). (J. Chem. Technol. Biotechnol.; 83, 10; 2008, Oct..; 1375-80).

A single-stage reactor, in which the growth of bacterial culture, induction of desulfurizing enzymes and desulfurization reaction that had been done in a single step, had been adopted to investigate desulfurization of dibenzothiophene(DBT) at high cell densities. *Rhodococcus erythropolis*, *IGTS8* had been used as the biocatalyst. Optimal conditions for bacterial growth and DBT desulfurization had been investigated. The necessity, of the optimization of fermentation conditions for obtaining high cell densities including controlling accumulation of acetate, is indicated. The maximum optical density at 600 nm(OD_{600}) had been measured to be 26.6 at 118 hours of cultivation under optimal operating conditions. The accumulation of sulfate had been found to limit the extent of desulfurization when biodesulfurization of DBT in model oil with a high cell density culture of *IGTS8* had been investigated. A sulfate removal step had been added to obtain a single-stage integrated biodesulfurization process. Sulfate removal had been achieved via an aqueous blood stream and use of a separation unit to recycle the organic phase. A proof of principle of a complete system capable of biocatalyst growth, induction, desulfurization and by-product separation had been demonstrated. This system enables simplification of the biodesulfurization process and has potential to lower the operating cost of the bioprocess. (23 Ref.; 6 Fig.).

44.10371

Effect of Azoreductase on the degradation of carcinogenic azo dyes. SURESH KUMAR (K), PONMURUGAN (P), MURUGESH (S), (Department of Biotechnology, K.S. Rangasami College of Technology, KSR Kalvi Nagar, Thokavadi, Thiruchengode – 637 215, Namakkal District, Tamil Nadu State, India). (Adv. BioTech; 8, 8; 2009, Feb.; 25-8).

A total, of four bacterial strains such as *Bacillus*, *Klebsilla*, *Pseudomonas* and *Staphylococcus spp.* were isolated from textile effluents to induce the secretion of extra cellular azoreductase for the biological degradation of azo dyes. Azoreductase was further purified and assayed which revealed 14000, 22000 and 36000 KDa protein molecules. Kinetic studies of azoreductase by *Pseudomonas spp.* to determine the suitable physical conditions during the enzyme production were performed under in vitro condition. The results showed that

the optimum pH and temperature was found to be 8 and 40°C respectively. The degradation of the azo dyes was evaluated by a UV-VIS spectrophotometer and high performance liquid chromatography (HPLC) system which revealed a prominent OD value at 519.57 nm was recorded in the samples treated with enzyme. Three minor peaks were noted with the same enzyme whereas time of 3.59 minutes. Some strains with potency to decolourize and/to remove chemical oxygen demand (COD) and biological oxygen demand (BOD) are discovered as a preliminary step in the development of textile effluent biotreatment using indigenous microbes. (12 Ref.; 1 Tab.; 9 Fig.).

44.10372

Effect of fungal enzyme (*Pleurotus florida*) on the decolourization of reactive dyes and textile effluents. SHANMUGAM (S), SATHISH KUMAR (J), RAJASEKARAN (P), PALVANNAN (T), (Department of Biotechnology, Kumaraguru College of Technology, No.: 2034, Chinnavedampatti, Coimbatore – 641 006, Tamil Nadu State, India). (Colourage; 55, 11; 2008, Nov.; 66-70).

Dyes are substances used to impart colour to fabric, food and other objects. Synthetic dyes are used extensively for textile dyeing and as additives in petroleum products. The textile dyeing process requires a large volume of fresh water with fairly high purity and discharges equally large volume of wastewater after dyeing process. The growth, of *Pleurotus florida* isolated from Western Ghats on potato dextrose broth exhibited laccase activity together with lignin peroxidase (0.10 U g⁻¹) and Manganese peroxidase (0.6 U g⁻¹) activity had been shown. The maximum amount of laccase produced was approximately 4.8 U g⁻¹ after 8 days of fermentation using 4-week old inoculums. The spore suspensions of *Bacillus subtilis* Cot A was used and it exhibited laccase like activity. The reactive dyes selected are reactive yellow, blue, green, purple and red for this work. The paper and textile effluents were collected. It was found that, out of five reactive dyes, a maximum decolourization was observed on reactive yellow (90%), reactive green (90%) and reactive blue (86%) using consolation of *Pleurotus florida* crude extracts and *Bacillus subtilis* CotA spore suspensions instead of *Pleurotus florida* crude extracts and *Bacillus subtilis* CotA spore suspensions. An evidence, ie. the enzyme obtained from the white rot fungi *Pleurotus florida* could remarkably help in the dye degradation of textile effluent, which is an ecofriendly, cost effective technology worth consideration by textile manufacturers, is provided. (22 Ref.; 2 Tab.).

44.10373

Silver-embedded granular activated carbon as an antibacterial medium for water. BANDOPADHYAYA (R), VENKATA SIVAIAH (M), SHANKAR (PA), (Chemical Engineering Department, Indian Institute of Technology of Bombay, Powai, Mumbai – 400 076, India). (J. Chem. Technol. Biotechnol.; 83, 8; 2008, Aug.; 1177-80).

Silver (Ag) particle embedded granular activated carbon (GAC) had been made for the first time to assess its ability in inhibiting the growth of *Escherichia coli* (*E. coli*), a water-borne bacterial pathogen. Ag-GAC had been made by impregnating GAC with AgNO₃ and then reducing it to metallic Ag. Plate assay had shown the slight inhibition of *E. coli*, even with Ag-GAC prepared from 0.005 molecule L⁻¹ AgNO₃, but this and shake

flask tests had shown a conspicuous effect only for higher concentrations of 0.1-1 molecule L⁻¹ AgNO₃. Flow tests further indicated that Ag-GAC made from 1.0 molecule L⁻¹ AgNO₃ caused a desirable three orders of reduction in *E.coli* number concentration in less than 30 seconds. An optimum of 9-10.5 weight % embedded Ag in the final Ag-GAC product was necessary for the requisite complete inhibition of *E.coli*, killing bacteria in the contact-mode for up to 35 L of flowing water. These results prove that Ag-GAC possesses antibacterial properties and can be used for disinfection to produce potable quality water. (6 Ref.; 4 Tab.; 2 Fig.).

44.10374

Tyrosinase and peroxidase production by *Rhizopus oryzae* strain ENME obtained from pentachlorophenol-contaminated soil. LEON-SENTIESTEBAN (H), BERNAL (R), FERNANDEZ (FJ), TOMASINI (A), (Depto de Biotecnologia, Universidad Autonoma Metropolitana-Iztapalapa, Postal 55-535, 09340 Mexico, Mexico). (J. Chem. Technol. Biotechnol.; 83, 10; 2008, Oct.; 1394-400).

An investigation, of the ability of a zygomycete isolated from pentachlorophenol(PCP)-contaminated soil to produce peroxidase and phenoloxidase enzymes and the determination, of the effect of tyrosine and PCP on the enzyme activities, are aimed. The ability, of the isolate to tolerate and remove PCP is studied. A zygomycete, which is capable of tolerating and removing PCP had been isolated from contaminated soil and identified by molecular techniques as *Rhizopus oryzae* strain ENHE. This fungus produced extra- and intracellular tyrosinase and extracellular lignin peroxidase. Tyrosinase activity increased with 0.1 grams tyrosine L⁻¹ added to the culture medium. PCP had no effect on tyrosinase activity but increased lignin peroxidase activity. It had been shown that *Rhizopus oryzae* ENHE grew until 100 mg PCP L⁻¹ and removed 90% of the initial PCP concentration of 12.5 mg L⁻¹ in 24 hours and the enzymes tyrosinase and lignin peroxidase had been probably involved in the PCP removal process. The results indicate that *Rhizopus oryzae* ENHE has the potential to be used to produce tyrosine and lignin peroxidase enzymes. The productions of these enzymes mainly by basidiomycetes in the few studies that report the production of peroxidase and extracellular tyrosine by fungi. (41 Ref.; 8 Fig.).

44.10375

Production of alkaline protease by *Bacillus circulans* using agricultural residues – A statistical approach. JASWAL (RK), KOCHER (GS), VIRK (MS), (Department of Microbiology, Punjab Agricultural University, Ludhiana – 141 004, Punjab State, India). (Indian J. Biotechnol.; 7, 3; 2008, Jul.; 356-60).

Bacillus circulans, an alkaline protease producer isolated from vegetable waste, showed a pH of 10.5, temperature between 25-30°C and agitation rate of 200 rpm as optimum physical conditions for enzyme production. Factorial experiments were designed and the best carbon-nitrogen(CN) combination of glucose and soybean meal produced a maximum alkaline protease of 461.65 U/mL. Soybean meal replaced with cotton deoiled meal(CDM) from enzyme production medium as the maximum, supporter of alkaline protease produced 589 U/mL of protease. Protease values with different concentrations of CDM fitted in a regression equation showed that *Bacillus circulans* produces maximum alkaline protease of 808.68 U mL⁻¹ in 100.9 hours using 0.5789% CDM. (18 Ref.; 5 Tab.).

44.10376

Optimization of transglutaminase extraction produced by *Bacillus circulans* BL32 on solid-state cultivation. de SOUZA (CFV), RODRIGUES (RC), HECK (JX), AYUB (MAZ), (Food Sciences and Technology Institute, Federal University of Rio Grande do Sul State, Av. Bento Goncalves 9500, P.O. Box 15090, ZC 91501-970, Porto Alegre, RS, Brazil). (J. Chem. Technol. Biotechnol.; 83, 9; 2008, Sep.; 1306-13).

The investigations, of the extraction of transglutaminase (TGase) produced by *Bacillus circulans* BL32 on solid-state cultivation in order to obtain a crude extract with the highest possible specific activity, are reported. The optimization, of downstream processing parameters for the effective recovery of the enzyme had been done by using response surface methodology based on the central composite rotatable design (CCRD) to reduce losses in the cultivated solids and to obtain a crude extract as concentrated as possible. Several solvents and temperatures had been tested, followed by 2³ factorial design performed to optimize conditions extraction time, mechanical agitation and solid : liquid ratio. The mathematical model had shown that solid : liquid ratio has a significant negative effect on transglutaminase recovery. The optimal conditions for extraction had been as water as solvent at 7°C Centigrade; 5 minutes extraction time; agitation speed 250 rates per minute (rpm) and 1:6 solid : liquid ratio. The model predicts activity recovery, very closely matching experimental activity of 0.285 U mg⁻¹ of protein, under those conditions. TGase recovery had achieved under the optimized extraction conditions, according to the CCRD, had been 2.5-fold higher than that obtained under previously employed non-optimized conditions. The results have shown the production of TGase in cheap solid state cultivations and the optimization, of its downstream processing parameters can improve enzyme recovery in crude extracts and may have important impacts on enzyme costs. (35 Ref.; 4 Tab.; 3 Fig.).

44.10377

Large scale expression, purification and characterization of an engineered prostacyclin-synthesizing enzyme with therapeutic potential. RUAN (K), SO (S), WU (H), CERVANTES (V), (The Department of Pharmaceutical Science, The Center for Experimental Therapeutics and Pharmacoloformatics, College of Pharmacy, University of Houston, Science & Research Building 2, Room 521, Houston, Texas 77204-5037, USA). (Arch. Biochem. Biophys.; 480, 1; 2008, Dec., 1; 41-50).

The successful production, of the active Triple Catalytic (TriCat) enzyme, first in large scale using a baculovirus (BV) system and its benefits for specifically up-regulating prostacyclin (PGI₂) biosynthesis and its potent anti-thrombosis properties, which are superior to that of the individual cyclooxygenase-2 (COX-2) and PGI, had been confirmed and further characterized. The studies have revealed a great potential for developing the innovative protein into a new therapeutic intervention for vascular disease requiring increased levels of PGI₂. (27 Ref.; 30 Fig.).

44.10378

Study on microbial diversity of wild Ass Sanctuary, Little Rana of Kutch, Gujarat, India. RINA (K), HIRAL (P), PAYAL (P), DHARIYA (N), PATEL (RK), (Department of Life Sciences, Hemachandracharya North Gujarat University, Rajmahal Road, Patan – 384 265, Gujarat State, India). (ICFAI Univ., J. Life Sci.; 3, 1; 2009, Feb.; 34-41).

The Wild Sanctuary Little Rann of Kutch is a typical ecological system with saline desert climate with least diversity and unique faunal diversity. The area has been declared as a Wildlife Sanctuary for protection of free ranging population of the Indian Wild Ass (*Equus heminus khur*). This unique ecosystem in the light of its microbial diversity is explored. Microorganisms had been isolated from the soil samples collected from different areas of the sanctuary by enrichment isolation technique using the variables of pH and salinity. Primary characterization of soil samples had been done with reference to Water Holding Capacity (WHC), pH, organic carbon, salinity and fluoride which revealed diverse and unique soil type. The isolates were further studied for morphological and biochemical heterogeneity. The investigated microflora were having dominated population including alkalophiles, halophiles and haloalkalophiles due to the hyper saline and hyper alkaline environment. Extremophilic isolates were further screened for extracellular enzyme in the extreme environment which suggests a possible biotechnological implication, besides the first significance in biodiversity and their role in the ecosystem. (8 Ref.; 5 Tab.; 4 Fig.).

44.10379

In vitro brain hydroxylase activation in catfish *Heteropneustes fossilis* (Bloch) : Seasonal changes in involvement of cAMP-dependent protein kinase A and Ca²⁺-dependent protein kinase C. CHAUBE (R), JOY (KP), (Department of Zoology, Banaras Hindu University, Varanasi – 221 005, Uttar Pradesh State, India). (Indian J. Exp. Biol.; 46, 11; 2008, Nov.; 764-9).

The involvement, of cyclicAMP (cAMP) dependent protein kinase A (PKA) and calcium-dependent protein kinase C (PKC) in the regulation of forebrain (telencephalon and hypothalamus) tyrosine hydroxylase (TH) activity had been demonstrated during the reproductive seasons of the female catfish *Heteropneustes fossilis*. In the concentration studies conducted in pre-spawning phase, cAMP (0.05 nM, 0.5 nM, 1 mM and 2.0 mM) or the phosphodiesterase inhibitor isobutylmethylxanthine (IBMX-0.5-2.0 mM) stimulated enzyme activity. Likewise, the incubation of the enzyme preparations with the cAMP dependent-protein kinase A inhibitor H-89 (1 and 10 μM) and PKC inhibitor calphostin C (cal C; 1 and 10 μM) inhibited enzyme activity in a concentration-dependent manner. In seasonal studies, the incubation of the enzyme preparations with cAMP (1 mM), IBMX (1 mM), H-89 (10 μM) and cal-C (10 μM) produced season-dependent effects on enzyme activity. The stimulatory effect of cAMP and IBMX and the inhibitory effect of H-89 and cal C had been greater in the resting and spawning phases. The results suggest the involvement of both signal transduction pathways in TH activation vis-à-vis catecholaminergic activity with a more dominant role by the cAMP-PKA pathway. (32 Ref.; 1 Tab.; 6 Fig.).

44.10380

Molecular level studies on multiple antibiotic and serum resistance in YTI pathogens. DHARMADHIKARI (SM), PESHWE (SA), (Department of Microbiology, Government Institute of Science, Caves Road, Aurangabad – 431 004, Maharashtra State, India). (Indian J. Biotechnol.; 8, 1; 2009, Jan.; 40-5).

A total of six pathogens comprising *Escherichia coli* (2), *Staphylococcus aureus* (2) and *Proteus sp.* (2) were isolated from wine samples of urinary tract infection (UTI) patient. They were examined for antibiotic and

serum resistance *Escherichia coli* BJ 83, coagulase positive *Staphylococcus aureus* and *Proteus sp.* Showed resistance to various antibiotics viz. ampicilin, cefuroxime, Streptomycin, etc. as well as resistance to 2% human serum. Amongst them, *Escherichia coli* BJ 83, which exhibited 62.5% resistance to various antibodies to serum, was selected for genetic evaluation as well as contransformation studies. Plasmid curing showed the location of antibiotic resistance markers on R plasmid. The presence of MDR plasmid in *Escherichia coli* BJ 83 was confirmed by performing *RFLP Escherichia coli* BJ 83 plasmid deoxyribonucleoro acid(DNA) profile showed λ_{max} at 260 nm and T_m of 90°Centigrade. Coexpression of ampicilin and serum resistance by recipient strain of *Escherichia coli* X-239, after plasmid transformation, confirmed that they are found to be linked markers. (17 Ref.; 5 Tab.; 5 Fig.).

POST-TANNING

FINISHING

44.10381

Influence of galvanic coupling on the formation of zinc phosphate coating. ARTHANAREESWARI (M), SANKARA NARAYANAN (TS), KAMARAJ (P), TAMIL SELVI (M), (Department of Chemistry, Faculty of Engineering, SRM University, SRM Nagar, Kattakulathur – 603 203, Kancheepuram District, Tamil Nadu State, India). (Indian J. Chem. Technol.; 17, 3; 2010, May; 167-75).

The influence, of galvanic coupling of mild steel(MS), with titanium, copper, brass, nickel and stainless steel(SS) on the phosphatability, is elucidated. The galvanic couple accelerates metal dissolution, enables quicker consumption of free phosphoric acid and facilitates an earlier attainment of point of incipient precipitation, resulting in higher amount of coating information. The surface morphology of the coatings exhibit more uniform coating for the mild steel substrates phosphate under coupled conditions. X-Ray Diffraction(XRD) pattern of the zinc phosphate coating formed under coupled condition confirms the presence of phosphophyllite rich coating. The potential-time measurements are also carried out. The galvanic coupling, of mild steel with metals, that are nobler than steel during phosphating, which proved to be beneficial in accelerating the coating formation, is revealed. (19 Ref.; 5 Tab.; 11 Fig.).

LEATHER CHEMICALS AND AUXILIARIES

44.10382

In-vitro dissolution rate enhancement of poorly water soluble non-steroidal antiadrogen agent, bicultamide, with hydrophilic carriers. SRIKANTH (MV), BABU (GVMM), SUNIL (SA), RAO (NS), RAMANA MURTHY (KV), (University College of Pharmaceutical Sciences, Andhra University, Visakhapatnam – 530 003, Andhra Pradesh State, India). (J. Sci. Ind. Res.; 69, 8; 2010, Aug.; 629-34).

The dissolution rate enhancement, of poorly water soluble antiandrogen agent, bicalutamide, using different solubilizing enhancers(Povidone K 30 and Poloxamer 407). Poloxamer 407 based dispersions exhibited higher dissolution rate than Povidone K 30. Powder X-ray diffraction(PXRD) had shown the degree of crystallinity decreased by increasing concentration of Povidone K 30 carrier. Fourier Transform Infrared(FTIR) studies had shown the drug used was compatible with carriers. Solid dispersions prepared with povidone K 30 changed crystalline form of drug to amorphous form. (17 Ref.; 1 Tab.; 6 Fig.).

44.10383

Fabrication of a dual substrate display to test roles of cell adhesion proteins in vesicle targeting to plasma membrane domains. HUNT (SJ), NELSON (WJ), (Department of Molecular and Cellular Physiology, Stanford University, School of Medicine, No. : 291 Campus Drive Room No. : LK3C02, Li Ka Shing Building 3rd Floor, Stanford, California 94305 - 5101, USA). (FEBS Lett.; 581, 23; 2007, Sep., 23; 4539-43).

While much is known of the molecular machinery involved in protein sorting during exocytosis, less is known about the special regulation of exocytosis at the plasma membrane(PM). A novel method, viz. : dual substrate display(PM) for formally testing the hypothesis that E-cadherin-mediated adhesion directs basolateral vesicle exocytosis to specific sites as the PM is outlined. Vesicles containing the basolateral marker protein VSV-G preferentially target to sites of adhesion to E-cadherin rather than collagen **VI** or a central peptide are shown. These results have supported the hypothesis that E-cadherin adhesion initiates signaling at the PM resulting in targeted sites for exocytosis. (11 Ref.; 8 Fig.).

44.10384

Activation of macrophages with N-formyl-methionyl-leucyl-phenylalanine : Involvement of protein kinase C and tyrosine kinase. SHRIVASTAVA (A), (Department of Zoology, University of Delhi, Delhi – 110 007, India). (Indian J. Exp. Biol.; 45, 9; 2007, Sep.; 755-63).

N-formyl-methionyl-leucyl-phenylalanine(fMLP), which is a potent chemotactic peptide stimulates immune responses by activating macrophages and other cells of the immune system. The inhibition, of fMLP-induced activation of murine peritoneal and P338D-1 macrophage cell line by protein kinase C(PKC) inhibitors, H-7 and chelery thrine chloride, are reported. Similarly, tumoricidal activity has been also downregulated by protein tyrosine kinase(PTK) inhibitors genestein and lavendustin A. Further, fMLP has increased tyrosine phosphorylation of several proteins in murine macrophages, which have inhibited in presence of genestein and lavendustin A. These findings suggest the involvement of PKC and PTK in the activation of murine macrophages with fMLP. (47 Ref.; 5 Tab.; 6 Fig.).

44.10385

Swelling behavior of ionically cross-linked polyampholytic hydrogels in varied salt solutions.ZHAO (Y), CHEN (W), YANG (Y), YANG (X), XU (H), (Department of Chemistry, Huazhong University of Science and Technology, Wuhan 430074, People's Republic of China). (Colloid Polym. Sci.; 285, 12; 2007, Sep.; 1395-400).

An ionic complex monomer has been obtained when weak basic (*N,N'*-diethylamino)ethylmethacrylate (DEAEM) has been protonated with weak acidic acrylic acid (AAc). The ionically cross-linked polyampholytic hydrogel poly (AAc-DEAEM-AAm) (designated as PADA) has been prepared through free radical copolymerization of the ionic complex with acrylamide (AAm). Ambient ions can be attracted to their opposite-charged groups on polymeric chains and weakened or destroyed ionic cross-linkages in PADA hydrogel. The swelling behavior of PADA gels with varied molar ratios of anionic/cationic monomers (A/C) have been investigated in aqueous sodium chloride, calcium chloride and trisodium citrate solutions for understanding the influence of the valent status, concentration and feature of ambient ions on the ionic cross-linkage in PADA hydrogels. (23 Ref.; 2 Tab.; 10 Fig.; 3 Schemes).

44.10386

Enantioselective [3+2]-Cycloadditions catalyzed by a protected, multifunctional phosphine-containing α -Amino acid. COWEN (BJ), MILLER (SJ), (Department of Chemistry, Yale University, P.O. Box 208107, New Haven, Connecticut 06520-8107, USA). (J. Am. Chem. Soc.; 129, 36; 2007, Sep., 12; 10988-9).

α -Amino acids of diphenylphosphinylamine (1), that lead to substantial enantiocontrol over the phosphine-catalyzed pathway, are reported. (15 Ref.; 3 Tab.; 1 Scheme).

44.10387

Characterization of oligonucleotide-Amino Acid conjugates by MALDI-TOF and HPLC. VILADKAR (SM), (The ICFAI institute of Science and Technology, The ICFAI University, Central Hope Town, Selaqui, Dehradun – 248 197, Uttarakhand State, India). (ICFAI J. Sci. Technol.; 3, 2; 2007, Sep.; 7-22).

The Matrix-assisted Laser Desorption Ionization Time-of-Flight(MALDI-TOF) technique along with reverse phase high performance liquid chromatography(HPLC) is used to study tagging of amino acids to small nucleic acid sequence. A stable amide bond is found when succinimide ester of amino acid is covalently linked to primary amine present on the linker arm of modified oligonucleotide. Coupling reaction is highly pH-dependent, at pH 8.5 almost complete conjugation of amino acids to oligonucleotide can be achieved within one hour. Incorporation of amino acids by succinimide ester allows a site-specific coupling of either at internal position of deoxyribonucleoro acid(DNA) sequence or at 5' terminus DNA sequence. Such a facile incorporation of amino acid or peptide may help in specific synthesis of antisense oligonucleotide with greater cell membrane permeability, stability and reactivity. (44 Ref.; 1 Tab. 5 Fig.; 1 Scheme).

44.10388

Mechanism of oxidation of hexamine by quinoliniumdichromate(QDC) in aqueous perchloric acid. CHIMATADAR (SA), MADAWALE (SV), NANDIBEWOOR (ST), (Post Graduate Department of Studies in Chemistry, Karnataka University, Dharwad 580 003, Karnataka State, India). (Indian J. Chem. Technol.; 14, 5; 2007, Sep.; 459-65).

The kinetics of oxidation of hexamine by quinoliniumdichromate(QDC) has been investigated spectrophotometrically in aqueous perchloric acid medium at constant ionic strength. The reaction is first order with respect to oxidant and reductant. Increase in perchloric acid concentration increases the reaction rate and order with respect to acid concentration is nearly two. The added products like chromium(III), formaldehyde and oxime do not have any significant effect on the rate of reaction. Increase in ionic strength and decrease in dielectric constant of the reaction medium increases the rate of reaction. A suitable mechanism is proposed and the constants involved have been obtained. The activation parameters had been evaluated with respect to slow step of the mechanism and discussed. (15 Ref.; 2 Tab.; 4 Fig.; 1 Scheme).

44.10389

Differential incorporation of decosahexaenoic acid into distinct cholesterol-rich membrane raft domains. DURAISAMY (Y), LAMBERT (D), O'NEILL (CA), PADFIELD (PJ), (Section of Gastrointestinal Sciences, Faculty of Medical and Human Sciences, University of Manchester, Oxford Road, Manchester M13 9PT, UK). (Biochem. Biophys. Res. Commun.; 360, 4; 2007, Sep., 7; 885-90).

The influence, of decosahexaenoic acid(DHA) on the fatty acid and protein compositions of two populations of membrane rafts, that are present in Caco-2 cells, is investigated. DHA(100 M) had no significant influence on the fatty acid or protein compositions of tight junction-associated, Lubrol insoluble, membrane rafts. However, DHA did significantly alter the fatty acid and protein compositions of "archetypal" Triton X-100 insoluble membrane rafts. The DHA content of the raft lipids has increased 25-fold and has been accompanied by a redistribution of src and fyn out of the rafts. DHA also has increased Caco-2 cell monolayer permeability which produces a 95% drop in transipithelial electrical resistance and a 8.56-fold increase in the flux of dextran. The data has demonstrated that DHA does not increase permeability through modifying the TJ-associated rafts. The data, do, however, show that DHA is differentially incorporated into different classes of membrane rafts, which has significant implications to the understanding of the way in which omega-3 polyunsaturated fatty acids(PUFAs) modulate plasma membrane organization and cell function. (17 Ref.; 2 Tab.; 4 Fig.).

44.10390

Transition metal complexes as electrocatalysts—Development and applications in electro-oxidation reactions. CHEUNG (K), WONG (W), MA (D), LAI (T), WONG (K), (Department of Applied Biology and Chemical Technology, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong, China). (Coordinat. Chem. Rev.; 251, 17-20; 2007, Sep.; 2367-85).

The utilization, of coordination compounds as electrocatalysts in a number of electro-oxidation reactions including oxidation of olefins, alcohols, water, glucose, nitric oxide and other small molecules is discussed. The coordination compounds function either as redox mediators and/or oxidative catalysts in the electrocatalytic reactions. The applications, of the electrocatalysts in electro-synthesis, biosensing and biofuel cells, are discussed with reference to the role played by the coordination compounds in these processes or technologies. (184 Ref.; 18 Fig.; 16 Schemes).

44.10391

Enhanced stability of cis Pro-Pro peptide bond in Pro-Pro-Phe sequence motif. DASGUPTA (B), CHAKRABARTI (P), BASU (G), (Department of Biochemistry, Bose Institute, P-1/12 CIT, Scheme VIIM, Room No. : 224, Kolkata – 700 054, India). (FEBS Lett.; 581, 23; 2007, Sep., 18; 4529-32).

An identification, of sequence motifs that favour cis peptide bonds in proteins is important for understanding and designing proteins containing turns mediated by cis peptide conformations. Pro-Pro peptide bond in Pro-Pro-Phe, that almost, equally populates the cis and trans isomers, with the cis isomer stabilized by a CH \cdots O interaction that involves the terminal Pro and Phe is shown from ^1H nuclear magnetic resonance (NMR) solution studies on short peptides. The over-representation, of Phe at sequence positions that immediately follow cis Pro-Pro motifs in known protein structures, is also shown. The results have demonstrated that the Pro-Pro cis conformer in Pro-Pro-Phe sequence motifs which is as important as the trans conformer, both in short peptides as well as in natively folded proteins. (26 Ref.; 2 Tab.; 7 Fig.).

44.10392

Crystal structure of YrrB : A TPR protein with an unusual peptide-binding site. HAN (D), OH (J), KIM (K), LIM (H), KIM (Y), (College of Medicine and Cancer Research Institute, Seoul National University, Yongon-Dong, Seoul 110-799, Republic of Korea). (Biochem. Biophys. Res. Commun.; 360, 4; 2007, Sep., 7; 784-90).

YrrB is a hypothetical protein that contains a tetratricopeptide repeat (TPR) domain from a Gram-positive bacterium, viz. : *Bacillus subtilis*. YrrB structure in the C2 space group to 2.5Å resolution, which is the first TPR structure of the Gram-positive bacterium *Bacillus subtilis*, is determined. In contrast to other known TPR structure, the conclave surface of the YrrB TPR domain is composed of the putative peptide-binding pocket lined with positively charged residues. This unique charge distribution reveals that Yrrb can interact with partner proteins via an unusual TPR-mediated interaction mode which is compared to that of other TPR-containing structures. Functional annotation by using genomics analysis has suggested that YrrB may be an interacting mediator in the complex formation among ribonucleoacid (RNA) sulfuration components. No proteins, that contain a TPR domain have been identified in the biosynthesis of sulfur-containing biomolecules. Thus, YrrB could play a new role as a connecting module among those proteins in the conserved gene cluster for RNA sulfuration. (33 Ref.; 11 Fig.).

44.10393

Pseudo second order model for cadmium ion sorption from aqueous solutions on to *Leucaena Glauca Benth*. NAGARAJAN (P), ISALIAH (S), ELEZABETH (DVS), (Bishop Heber College, Post Graduate and Research Department of Chemistry, Post Box No.: 615, Trichy – 620 017, Tamil Nadu State, India). (Indian J. Environ. Protect.; 27, 9; 2007, Sep.; 789-98).

The successful utilization, of the acid processed *Leucaena Glauca Benth* for removing cadmium (II) from aqueous solution, is discussed. The adsorbent has been characterized by Fourier Transform Infrared (FTIR),

Scanning Electron Microscopy(SEM), X-ray fluorescence spectrometer. The sorption data have been analyzed and fitted to linearised isotherms of the Freundlich, Langmuir and Redlich-peterson models. The batch sorption kinetics have been tested for pseudo first order, second order reaction models. The rate constants of adsorption for these kinetic models and also the intra particle diffusion parameters have been calculated. The calculated film diffusion coefficient and pore diffusion coefficient indicates that the film diffusion has been the rate limiting step. (35 Ref.; 6 Tab.; 6 Fig.).

44.10394

Adsorption kinetics and thermodynamics of copper metal ion on to acid activated low cost carbon. VENKATRAMAN (BR), RAJACHANDRASEKAR (T), HEMA (M), ARIVOLI (S), (M.R. Government Arts College, P.G. Department of Chemistry, Mannargudi – 614 001, Tanjore District, Tamil Nadu State, India). (Indian J. Environ. Protect.; 27, 9; 2007, Sep.; 813-23).

Batch experiments had been done to sorp the copper ion onto prepared acid activated carbon from which the operating variables such as initial metal ion concentration, temperature and contact time had been studied. Equilibrium data fitted to the Langmuir and Freundlich isotherm equations. Adsorption energy, Adsorption capacity, intensity of Adsorption and dimensionless separation factor had been calculated from this adsorption efficiency. The rate constant values for the adsorption process had been calculated from the kinetic studies. The thermodynamic parameters, like G, H and S have been calculated from the effect of temperature. The mechanism of adsorption for the dye onto carbon have been investigated by using the experimental results and confirmed by Fourier Transform-Infrared (FT-IR), X-Ray Diffraction(XRD) and Scanning Electron Microscope(SEM) images. (27 Ref.; 6 Tab.; 13 Fig.).

44.10395

Highly selective ferric ion sorption and exchange by crystalline metal phosphonates constructed from tetrakisphosphonic acids. WU (J), HOU (H), HAN (H), FAN (Y), (Department of Chemistry, Zhengzhou University, Henan 450052, People's Republic of China). (Inorg. Chem.(including bio-inorganic chemistry); 46, 19; 2007, Sep., 17; 7960-70).

A tetrakisphosphonic acid, viz. :[(H₂O₃PCH₂)₂N(CH₂)₂N(CH₂PO₃H₂)₂](H₈EDTP) is used to prepare two novel divalent metal tetrakisphosphonates, namely, {[Pb₇(HEDTP)₂-(H₂O)]·7H₂O}_n (1), whose structure features a three-dimensional microporous network with tunnels along the a and b axes and {[Zn₂(H₄EDTP).2H₂O]_n (2), whose structure contains square-wave-like layers interconnected by hydrogen bonds to form a three-dimensional supramolecular network, with one-dimensional tunnels along the a axis. Both compounds show highly selective cation sorption and exchange capacities for Fe^{III} ions versus other metal ions and become promising candidates for effective clinical iron chelators. It is thought that the selective ferric ion sorption of such compounds may arise not only from ion exchange but also from the strong coordination bonding and electrostatic attractions to ferric ions with phosphonate groups. (24 Ref.; 2 Tab.; 15 Fig.; 1 Chart).

44.10396

Alkylphenol ethylene oxide condensates(APEO). WAKANKAR (DM), (The Corporate Product Safety Department, M/s. Clariant Chemicals(India) Limited, Kences Towers, Second Floor, No. : 1, Ramakrishna Road, Thyagaraya Nagar, Chennai – 600 017, India). (Colourage; 54, 9; 2007, Sep.; 96-8 & 102).

Various aspects, of alkylphenol ethylene oxide condensates(APEO), are discussed in detail. (8 Ref.; 3 Fig.).

44.10397

Removal of copper from water samples by sorption onto powdered limestone. GHAZY (AH), RAGAB (AH), (Chemistry Department, Faculty of Science, Mansoura University, P.O. Box 66, Mansoura, Egypt). (Indian J. Chem. Technol.; 14, 5; 2007, Sep.; 507-14).

The results, of a study that concerns with Cu(II) removal from aqueous systems by batch adsorption experiments by using fine powdered Limestone(LS) as an effective sorbent which is widespread and cheap, are described. The parameters, such as initial solution pH, sorbent and copper concentrations, stirring times and temperature which influences sorption process, in adding to the effect of some foreign ions, had been investigated. The obtained results had shown that the sorption of Cu²⁺ ions onto LS is exothermic and spontaneous in nature and followed first-order kinetics. The adsorption data had been well described by Langmuir Freundlich, Dubinin-Radushkevich (D-R) adsorption models over the studied concentration range. The removal of ca.100% of Cu²⁺ ions had been obtained under the employed optimum experimental conditions. The procedure had been successfully applied to the removal of copper from aqueous and different natural water samples. The adsorption mechanism is also suggested. (41 Ref.; 2 Tab.; 9 Fig.).

44.10398

Plastics industry awaits upturn in construction sector to make most of its innovations. (Chem. Wkly.; 55, 49; 2010, Jul., 20; 207-8).

The role, which is being played by the plastics industry for the betterment in the construction sector for making most of its innovations, is discussed in detail. (2 Photos).

44.10399

Methyl Methacrylate : A Techno-Commercial profile – Part 1 : Manufacturing Technology. (Chem. Wkly.; 55, 46; 2010, Jun., 29; 203-10).

The first commercial process for making methyl methacrylate(MMA), the acetone cyanohydrin(ACH) route, remains the predominant process in use today, in spite of being developed as far back as the 1930s. But MMA can be commercially manufactured by a number of other routes, as well, using alternate raw materials. Some of the currently used process and a few others, which are still under development, are highlighted. (3 Tab.; 11 Fig.).

44.10400

Synthesis of 5,4'-dihydroxy-7,3'-dimethoxy flavones. YADAV (RV), REDDY (KI), (Department of Chemistry, Natural Products Laboratory, Dr. Hari Singh Gour Central University, Sagar – 470 003, Madhya Pradesh State, India). (J. Inst. Chem.(India); 82, 5; 2010; 145-7).

Flavonoids are generally occurring from plants as aglycones and glycosides, which possess significant biological activities including antiviral, antimalarial, antiulcer and antihepatotoxic etc. The necessity, of synthesizing flavonoid, 5,4'-dihydroxy-7,3'-dimethoxy flavones which has been isolated from the leaves of *Ceanothus velutinus* in view of the biological interest of flavonoids, is felt. The synthetic preparation, of title compound from the alkaline condensation of 2,6-dihydroxy-4-methoxy acetophenone(I) and 4-hydroxy-3-methoxy benzaldehyde(II) yield the chalcone derivative(III), which on treatment with 2,3-dichloro-5,6-dicyanobenzoquinone(DDQ) gave compound(IV), is reported. Its structure was elucidated by various spectral analysis and was compared with reported literature values. (8 Ref.; 1 Scheme).

44.10401

Aspergillus niger Van Tiegh., A promising bioprospecting fungus for the production of exopolysaccharide. SENTHILKUMAR (N), MURUGESAN (S), (Division of Bioprospecting, Institute of Forest Genetics and Tree Breeding, Forest Campus, R.S. Puram, Coimbatore-461 002, Tamil Nadu State, India).(Adv. BioTech; 9, 12; 2010, Jun.; 44-7).

The use, of *Aspergillus niger*, for fermentative production of exopolysaccharide by bioprospecting fungus, was studied. Sucrose and maltose were used as carbon sources. Polysaccharide production was maximum in 8 & 10% of substrates. Polysaccharide production was increased with increase in growth of mycelium of *Aspergillus niger* in both the substrates. The optimum pH and incubation periods for the maximum production of polysaccharide were pH 7 and 15 days respectively. The polysaccharide produced by *Aspergillus niger* was the polyol of 3,4,6 tri-o-methyl D glucose with -1-3 glucosidic linkage commonly known as glucan. The polysaccharide produced by this species may be composed of glucose and little amount of galactose and other oligosaccharides. Polarimetric studies revealed that the fractions containing glucose gave laevorotatory values of the optical rotation. Total acidity was maximum in pH 4 and total carbohydrate, reducing sugar was maximum in pH 4 and total carbohydrate, reducing sugar was maximum in pH 7, protein and nitrogen values were varied as per experimental conditions. (34 Ref.; 2 Tab.).

44.10402

Conductometric studies on salvation behavior of citric acid in water + methanol and water + ethanol mixtures at different temperatures. ISHWARA BHAT (J), MANJUNATHA (MN), (Department of Chemistry, Mangalore University, Mangalagangothri – 574 199, Karnataka State, India). (Indian J. Chem. Technol.; 17, 6; 2010, Nov.; 462-7).

The study, on the effect of salvation of the species of citric acid in water + methanol and water + ethanol mixtures(volume/volume) on its conductivity behavior as a function of temperature, is reported. The specific

conductance was measured in the temperature range 283-313 K and the evaluated equivalent conductance was analyzed by Kraus-Bray and Shedlovsky models of conductivity. Limiting molar conductance(Λ_m^0), dissociation constant(K_c) and association constant(K_a) were evaluated for all solvent compositions. The limiting molar conductance was found to decrease with the increase in amount of co-solvent to water. K_c increased with increase in temperature till 60% methanol and 40% ethanol with a later decrease. Fuoss Accascina equation was applied and the formation, of ion pairs and scanty amount of ion triplets takes place in the system, is proved. Walden product, corrected Stokes radius(\bar{a}_i), thermodynamic parameters and salvation number also have been evaluated. Born relation of salvation was verified. These data were used to study the nature of ion-solvent and solvent-solvent interactions existing in the system under prevailing conditions. (17 Ref.; 6 Tab.).

44.10403

Novel technology option for value addition of natural gas. (Chem. Wkly.; 55, 14; 2009, Nov., 17; 209-12).

Natural gas is the fastest growing energy resource in most regions of the world, driven by superior environmental performance, as well as attractive economics for base-load use in power generation. There is a drive to develop new technologies to allow efficient and cost-effective monetization of these stranded assets. Various options for monetization of natural gas are listed. High-value products such as synthetic fuels and chemicals produced directly from natural gas; fuels and chemicals from natural gas via methanol; and electric power from methanol are described. Two broad technologies for gas-to-liquids to produce a synthetic petroleum(syn crude) namely a direct conversion from gas; and an indirect conversion via synthesis gas(syngas) are also described. Both the Synfuels technology and the synfuels ECLAIRS technology are described. A process, for producing a gasoline product from a natural gas feed consists of four main steps namely conversion; absorption; hydrogenation and oligomerisation, is described. This process is economically analysed. (2 Ref.; 1 Tab.; 2 Fig.).

44.10404

Catalytic synthesis of ZnO nanorods on patterned silica wafer-An optimum material for gas sensor. PANDA (SK), JACOB (C), (Materials Science Center, Indian Institute of Technology of Kharagpur, Kharagpur – 721 302, West Bengal State, India). (Bull. Mater. Sci.; 32, 5; 2009, Oct.; 493-8).

ZnO nanorods have been synthesized over etch-patterned Si(110) wafer using annealed silver thin film as growth catalyst. The growth of ZnO nanorods were performed by a two-step process. Initially, the deposition of Zn thin films was done on the annealed silver catalyst film over the etch-patterned Si(110) substrate by thermal evaporation and then annealed at 800°C in air. The etching of the patterned Si(110) wafers was carried out by 50% aqueous KOH solution. The samples were investigated by optical microscopy, scanning electron microscopy(SEM), X-ray diffraction(XRD), Raman spectroscopy and room temperature photoluminescence spectroscopy(RTPLS). 'V' shaped grooves with no undercut were found after etching due to the anisotropic nature of the KOH etchant. The etch-patterned wafer was used to provide larger surface area for ZnO growth by forming 'V'-grooves. This ZnO film may be predicted as a very good material for gas sensor. (33 Ref.; 13 Fig.).

44.10405

Preparation of copper and silicon/copper powders by a gas evaporation-condensation method. TEMUJIN (J), BARDAKHANOV (SP), NOMOEV (AV), ZAIKOVSKII (VI), MINJIGMAA (A), DUGERSUREN (G), Van RIESSEN (A), (Centre for Materials Research, Department of Imaging and Applied Physics, Curtin University of Technology, GPO Box U1987, Perth-6845, Western Australia, Australia and Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Ulaanbaatar 51, Mongolia). (Bull. Mater. Sci.; 32, 5; 2009, Oct.; 543-7).

Pure and silicon-coated copper nano to submicron-sized powders were prepared by gas evaporation and condensation. This powder was synthesized by using an industrial electron accelerator, ELV-6, with Ar as the carrier gas. Vapour from the liquefied metal surface was transferred to the cold zone by the carrier gas and precipitated as Spherical Cu metal and Si/Cu composite powders. The mean diameter of the resulting powder was 100-200 nm. (13 Ref.; 7 Fig.).

44.10406

Hybrid textiles : A review. OMAR (S), GOEL (A), (Department of Clothing & Textiles, College of Home Science, Govind Ballabh Pant University of Agriculture and Technology, Pant Nagar – 263 145, Uttarakhand State, India). (Colourage; 56, 12; 2009, Dec.; 93-6 & 105).

Technical textiles in various contexts are often referred to as performance textiles or functional textiles or engineered textiles or high-tech textiles. Technical products like woven, knitted braided, non-woven(link) and wound reinforcements produced from glass, carbon fiber and organic polymer materials like aramids are presently accepted as technical textile products. Heavy materials in hybrid materials are partially substituted by flexible textile-based rigid materials such as glass, carbon, metal and ceramics. The resultant lighter weight is used widely in the construction and automobile industries. Absorption of seismic shocks, acoustic absorption, vibration absorption and thermal insulation are properties that ensure their continued application. (7 Ref.; 1 Tab.; 3 Fig.).

44.10407

Graphene : a fascinating material. SAHOO (S), SAHOO (SK), (Department of Physics, National Institute of Technology, Bardhaman Central Avenue, Durgapur – 713 209, West Bengal State, India). (Indian J. Sci. Technol.; 2, 12; 2009, Dec.; 74-8).

Graphene is the first two-dimensional allotrope of carbon. Recent theoretical studies of grapheme reveal that the linear electronic band dispersion near the Brillouin zone corners give rise to electrons and holes that propagate as if they are massless fermions and anomalous quantum transport is observed experimentally. Graphene has potential for serving as an excellent electronic material that can be used in place of silicon for making ultrafast and stable transistors. It is considered as a promising candidate for electronics and spintronics applications. It provides a bridge between condensed matter physics and quantum electrodynamics. (30 Ref.; 4 Fig.).

44.10408

Production of prodigiosin from *Serratia marcescens* isolated from soil. SUNDARAMOORTHY (N), YOGESH (P), DHANDAPANI (R), (Department of Microbiology, Adhiparasakthi College of Arts & Science, G.B. Nagar, Karavai-632 506, Vellore District, Tamil Nadu State, India). (Indian J. Sci. Technol.; 2, 10; 2009, Oct.; 32-4).

Prodigiosin is a promising drug owing to its reported characteristics of having antifungal, immunosuppressive and anti-proliferative activity. Prodigiosin was first characterized from *Serratia marcescens*. The screening, of new strains of *Serratia* that effectively produce prodigiosin, is investigated. A new strain designated as *Serratia marcescens* NY1 was isolated. The parameters viz. temperature, pH, sugar substrate and oil substrate were optimized to increase the production of prodigiosin. The maximum amount, of prodigiosin, that produced at temperature 30°C and pH 7.0, was observed. Among the different sugar substrates tested maltose when amended in the medium yielded 425±40 mg/L of prodigiosin. Oil substrates play a vital role in prodigiosin production. The production of prodigiosin was maximum (533±45 mg/L) among the various oil substrates when the medium was amended with peanut oil. (13 Ref.; 4 Fig.).

44.10409

Studies on the effect of ethanol addition to biodiesel : Performance and emission of a diesel engine. PUGAZHVADIVU (M), (Department of Mechanical Engineering, Pondicherry Engineering College, Pillaichavadi, Puducherry-605 014, India). (Indian J. Sci. Technol.; 2, 11; 2009, Nov.; 23-6).

The interest on alternative fuels is continuously increasing to meet the growing energy needs and protect the environment. Ethanol and biodiesel are two potential and promising alternative fuels for internal combustion engines. Ethanol can be used with biodiesel fuel to extend the availability of diesel. A single cylinder diesel engine using B25, B50, B75 and B100 biodiesel blends with 5% and 10% ethanol addition is experimentally investigated. The engine performance and emission characteristics were also investigated. The thermal efficiency, NO_x and smoke emissions were found experimentally. The addition of ethanol to biodiesel diesel blends did not alter the engine performance significantly. The engine produced lower NO_x and smoke emission with ethanol addition. (13 Ref.; 2 Tab.; 9 Fig.).

44. 10410

Kinetic study of the esterification of free fatty acids in non-edible Pongamia oil using acid catalyst. THIRUVENGADARAVI (KV), NANDAGOPAL (J), BALA (VSS), KIRUPHA (SD), VIJAYALAKSHMI (P), SIVANESAN (S), (Department of Chemistry, Velammal Engineering College, Velammal Nagar, Ambattur, Red Hills Road, Chennai – 600 066, India). (Indian J. Sci. Technol.; 2, 12; 2009, Dec.; 20-4).

Pre-Treatment of high free acid containing *Pongamia pinnata* oil using sulfuric acid catalyst has been optimized. The kinetics of the pre treatment esterification process was studied. The experimental results were found to fit a Pseudo first-order kinetics. The influence of temperature on the rate constants was determined by fitting the results to be the Arrhenius equation. The activation energy and frequency factor were favourable

for the forward reaction. A methanol to oil ratio of 9:1, one percentage catalyst by weight and a temperature of 60°C were selected as the optimum settings for the esterification process on the basis of the experimental results. (23 Ref.; 4 Tab.; 7 Fig.).

FINISHING MATERIALS

44.10411

Isolation of 1,4-naphthalenedione, antibacterial principle from the leaves of *Holoptelea integrifolia* and its activity against β -lactam resistant *Staphylococcus aureus*. VINOD (NV), HARIDAS (M), SADASIVAN (C), (Department of Biochemistry and Microbiology, Kannur University, Thalassery Campus, Palayad PO – 670 661, Kerala State, India). (Indian J. Biochem. Biophys.; 47, 1; 2010, Feb.; 53-5).

Antimicrobials derived from plants have been receiving increasing attention in recent years. Antimicrobial activities of a number of phytochemicals have been reported. Many present day antibiotics are ineffective against several pathogenic organisms. About 90% of *Staphylococcus aureus* isolates from clinical specimens is reported to have resistance against β -lactam antibiotics. The effect of hexane, diethyl ether, acetone and water extracts of leaves of a medicinal plant *Holoptelea integrifolia* has been tested against β -lactam resistant strain of *Staphylococcus aureus* in presence of antibiotics such as ampicillin, amoxicillin, cefotaxime and ceftriaxone. The diethyl ether extract has shown the maximum antibacterial activity and the active principle is found to be 1,4-naphthalenedione which is characterized by Gas Chromatography-Mass Spectroscopy (GC-MS) and Fourier Transform Infrared (FTIR) spectroscopy. The maximum inhibitory concentration (MIC) of the compound is found to be 4 mg/ml. Structural similarity of this compound with a functional group of a β -lactamase-resistant antibiotic indicates that 1,4-naphthalenedione may be acting as an inhibitor to β -lactamase. (18 Ref.; 1 Tab.).

44.10412

Decolourization of textile dyes by *Aspergillus tamaris*, mixed fungal culture and *Penicillium purpurogenum*. RAMALINGAM, SARASWATHY (N), SHANMUGAPRIYA (S), SHAKTHIPRIYADARSHINI (S), SADASIVAM (S), SHANMUGAPRAKASH (M), (Department of Biotechnology, Kumaraguru College of Technology (KCT), Post Box No. : 2034, Coimbatore – 641 006, Tamil Nadu State, India). (J. Sci. Ind. Res.; 69, 2; 2010, Feb.; 151-3).

The degradation ability of *Aspergillus tamaris*, mixed fungal culture (*Trichoderma sp.*, and *Aspergillus flavus*) and *Penicillium purpurogenum* on various synthetic dyes. *Aspergillus tamaris* decolourized (>90%) of coomassie brilliant blue (CBB) bromophenol blue (BPB) and malachite green (MG) dyes. Mixed fungal culture decolourized CBB, 74; BPB:78 and MG, 45%. *Penicillium purpurogenum* decolourized : CBB, 91; BPB, 92: and MG, 52%. Dye decolourization was achieved by metabolism rather than by adsorption. Isolated fungal strains could effectively be used in development of alternative and eco-friendly method for removal and degradation of textile dyes. (6 Ref.; 1 Fig.).

LEATHER PROCESSING MACHINES

44.10413

Comparison of hexagon and octagon cylinder models with conventional models for effective thermal conductivity estimation of suspension systems. SENTHIL KUMAR (AP), RAJA (VP), KARTHIKEYAN (P), (Department of Mechanical Engineering, PSG College of Technology, Post Box No. : 161, Avinashi Road, Peelamedu, Coimbatore – 641 004, Tamil Nadu State, India). (J. Sci. Ind. Res.; 69, 5; 2010, May; 356-64).

Hexagon and octagon cylinder models for effective thermal conductivity estimation of suspension systems, are presented. Algebraic equations were derived based on isotherm approach for two dimensional spatially periodic medium. Model prediction was achieved with minimum($\pm 10.83\%$) and maximum($\pm 15.58\%$) deviation from experimental data for suspension systems. Model prediction was comparable with conventional methods. (21 Ref.; 2 Tab.; 9 Fig.).

44.10414

Light water nuclear reactors (LWNR). VERMA (SS), (Department of Physics, Sant Longowal Institute of Engineering and Technology, Longowal – 148 106, Sangrur District, Punjab State, India). (Chem. Wkly.; 55, 18; 2009, Dec., 15; 196-7).

The meanings, of the terms namely nuclear power and light water nuclear reactor, are defined. The advantages and disadvantages of light water nuclear reactor, are described. (1 Photo).

LEATHER PROPERTIES. QUALITY CONTROL

44.10415

Alternative systems to the chrome tannage : from chrome free to metal free. NAVIGLIO (B), CALVANESE (G), AVETA (R), CARCCIOLO (D), GIRARDI (V), SCOTTI (M), TORTORA (G), ROMAGNOLO (M). (Stazione Sperimentale per l'Industria delle Pelli e delle Materie Concianti, Via Buona Poggioreale, 39 80143 Napoli, Italy). (Cuoio Pelli Mater. Concian.; 86, 5; 2010, Sep./Oct.; 275-89). (Italian).

Stazione Sperimentale per l'Industria(SSIP) received many requests for determination of metal content of leathers in the last times in order to be defined as metal free. It is noticed through various analyses that in the absence of chromium modern leathers can present different types of metal tanning agents as Aluminium or Titanium. Thus they cannot be considered as metal free leathers. In most of cases, the examined samples were tanned with phosphonium salts, syntans or sulfochloroparaffins. These tanning procedures are described in general terms are described and the mechanical and chemical properties of leathers obtained by their application are reported. At the same time, the practical meaning of particular definitions used for trading eco-friendly leathers, such as wet-white, chrome-free and metal-free are reported. Finally, the need, of life cycle assessment of leather products for the comparison of different tanning procedures, is treated. (15 Ref.; 6 Tab.; 9 Fig.).

BY-PRODUCTS

44.10416

Glycerol as a feedstock for chemical manufacture : Recent developments. (Chem. Wkly.; 55, 10; 2009, Oct., 20; 185-92).

Glycerine is one of several common names for the polyhydric alcohol that forms the backbone of natural oils and fats. Its other names such as glycerol, trihydroxy propane and propane 1,2,3-triol, are also often used interchangeably. Glycerol is reserved for the pure chemical compound, propane-1,2,3-triol, which is the simplest trihydric alcohol. The term glycerine generally applies to the several grades of purified commercial products that usually contain a minimum of 95% glycerol. Glycerine is applied in various fields such as (a) solvent or vehicle for pharmaceutical products; (b) Humectant in cosmetics and tobacco; (c) Plasticizer for polymers; (d) Anti-freeze and heat transfer of fluid; (e) hydraulic fluid; (f) intermediate in the production of lubricants, polyurethanes, mono- and di-glycerides. Additionally, glycerol is increasingly used as a raw material and feedstock for the manufacture of a number of commodity and specialty chemicals. This is driven by the prospects of improved availability of glycerine as a by-product from the bio-diesel industry. The highlights of the developments in these applications of glycerol are focused. (2 Tab.; 3 Fig.).

44.10417

Agricultural and agro-processing wastes as low cost adsorbents for metal removal from wastewater : A review. JOHNSON (TA), JAIN (N), JOSHI (HC), SHIV PRASAD, (Division of Environmental Sciences, Indian Agricultural Research Institute(ICAR), First Floor, Krishi Anusandhan Bhawan I, Pusa, New Delhi – 110 012, India). (J. Sci. Ind. Res.; 67, 9; 2008, Sep.; 647-58).

The use, of agricultural and agro-processing industry wastes as metal adsorbents from wastewater, is reviewed. Modified materials displayed better adsorption capacity and capability of some was comparable with that of commercial activated carbons and synthetic resins. Agricultural wastes are low-cost adsorbents and can be viable alternatives to activated carbon for treatment of metal-contaminated wastewater. (163 Ref.; 6 Tab.).

44.10418

Simultaneous degradation of nitroaromatic compounds TNT, RDX, atrazine and simazine by *Pseudomonas putida HK-6* in bench-scale bioreactors. CHO (Y), LEE (B), OH (K). (Department of Biotechnology, Soonchunyang University, PO Box 97, Asan, Chung-Nam 336 600, Republic of Korea). (J. Chem. Technol. Biotechnol.; 83, 9; 2008, Sep.; 1211-7).

Environmental contamination by nitroaromatic compounds such as 2,4,6-trinitrotoluene(TNT), hexahydro-1,3,5-trinitro-1,3,5-triazine(RDX), atrazine and/or simazine(TRAS) generated as waste from military and agricultural activities is a serious problem. Microbiological treatment of these compounds is an attractive method

because many explosives and herbicides are biodegradable and the process can be made cost-effective. The feasibility, of using cultures of *Pseudomonas putida HK-6* for simultaneous degradation of TRAS is explored with the aim of microbial application in wastewater treatment in bench-scale bioreactors. Experiments had been conducted to study the effects of supplemental carbons, nitrogens and Tween-80 on the degradation of *Pseudomonas putida HK-6* in media containing TRAS as target substrate(s). The most effective TRAS degradation had been shown in the presence of molasses. The addition of nitrogen sources produced a delayed effect for the target substrate(s). Tween-80 enhanced the degradation of target substrate(s). Simultaneous degradation of these compounds succeeded to completion within the given period. *Pseudomonas Putida* had been capable of growth with TRAS and the effects of supplements on TRAS degradation and simultaneous TRAS degradation had been evaluated in bench-scale bioreactors. The results of this study have practical applications in the processes of industrial waste stream treatment where the disposal of TRAS may be problematic. (31 Ref.; 1 Tab.; 16 Fig.,).

44.10419

Bioleaching of low-grade copper ore using indigenous microorganisms. PRADHAN (D), PAL (S), SUKLA (LB), ROY CHAUDHURY (G), DAS (T), (Institute of Minerals and Materials Technology(IMMT), Council of Scientific and Industrial Research (CSIR), Bhubaneshwar – 751 013, Orissa State, India). (Indian J. Chem. Technol.; 15, 6; 2008, Nov.; 588-92).

The iron oxidation rate of *Acidithiobacillus ferroxidans* and the bacteria used in bioleaching process, are investigated. The regeneration time of the bacteria is reduced from 168 to 16 hours by repeated sub-culturing which in turn gave rise to the higher iron oxidation rate thus increasing the kinetics of the process. This active strain had been utilized for bioleaching of low-grade copper or by varying two parameters namely pH and pulp density. Around 30% copper that could leach at an initial pH and pulp density of 2 and 20%(m/v) respectively had been observed. (13 Ref.; 1 Tab.; 11 Fig.).

44.10420

Development of ion exchanger by modification of polypropylene fibre waste using radiation-induced graft polymerization of acrylamide and subsequent amination. GUPTA (B), KANDA (V), SETHI (P), SAXENA (S), (Department of Textile Technology, Indian Institute of Technology(IIT) of New Delhi, Hauz Khas, New Delhi – 110 016, India). (Indian J. Fibre Text. Res.; 33, 4; 2008, Dec.; 431-7).

Radiation-induced graft polymerization of acrylamide onto polypropylene fibre waste has been by using pre-irradiation technique to develop material with different degrees of grafting. The influence of reaction conditions, such as pre-irradiation dose, monomer concentration, reaction time and ferrous sulfate, on the degree of grafting has also been studied. The addition of ferrous sulfate beyond 0.4% concentration leads to the homopolymer free grafting reaction. The degree of grafting increases with the increase in the monomer concentration. A continuous increase in the grafting is achieved with the pre-irradiation dose. The replacement of

the ferrous sulphate with acetone as an organic solvent causes complete homopolymer inhibition but a much lower graft levels as compared to the ferrous sulphate addition. The grafted fibre is subsequently animated by Hoffmann degradation method and the fibre with a maximum ion exchange capacity up to 6.2 meq/g for a graft level of 198% is achieved. The modified fibre also shows excellent water uptake which increases as the degree of grafting increases. (36 Ref.; 1 Tab.; 7 Fig).

44.10421

Removal of dimethyl sulfide in a thermophilic membrane bioreactor. LUVSANJAMBA (M), AMIT KUMAR, Van LANGENHOVE (H), (EnVOC Research Group, Faculty of Bioscience Engineering, Ghent University, Coupure Links 653, B-9000 Gent, Belgium). (J. Chem. Technol. Biotechnol.; 83, 9; 2008, Sep.; 1218-25).

Several sources such as paper and pulp industry and waste treatment plants emit waste gases containing volatile organic sulfur compounds at elevated temperature. Since cooling the hot gases increases the operational cost of biological reactors, application of thermophilic microorganisms could be a cost-effective solution. An investigation, of the possibility of removal of dimethyl sulfide from waste gases under thermophilic conditions (52°C Centigrade) in a membrane bioreactor and an examination, of the long-term stability of the reactor at elevated temperature, are aimed. The effects, of operating conditions such as gas residence time, nutrient supply, temperature decrease and short-time shutdown on elimination capacity, had been investigated. A maximum elimination capacity of $54 \text{ g m}^{-3} \text{ h}^{-1}$ ($0.108 \text{ g m}^{-2} \text{ h}^{-1}$) had been obtained at a mass loading rate of $64 \text{ g m}^{-3} \text{ h}^{-1}$ ($0.128 \text{ g m}^{-2} \text{ h}^{-1}$) with a removal efficiency of 84% at a gas residence time of 24 seconds. The long-time operation of the thermophilic membrane bioreactor had been followed for 9 months. Although the removal efficiency had been decreased to 50% after 3 months of continuous operation, it recovered (>96%) after the excess biomass had been removed by applying high-velocity liquid recirculation. The possibility, of removing dimethyl sulfide in a thermophilic membrane bioreactor with an elimination capacity of ($54 \text{ g m}^{-2} \text{ h}^{-1}$) at a gas residence time of 24 seconds, is demonstrated. (32 Ref.; 2 Tab.; 5 Fig.).

44.10422

Separation of Zn (II) by sorption onto powdered marble wastes. GHAZY (SE), GAD (AHM), (Chemistry Department, Faculty of Science, Mansoura University, P.O. Box 66, Mansoura, Egypt). (Indian J. Chem. Technol.; 15, 5; 2008, Sep.; 433-42).

Batch adsorption experiments had been done to remove Zn (II) ions from aqueous solutions and water samples using powdered marble wastes (PMW) as an effective sorbent which is inexpensive, widespread and considered as an environmental problem. The parameters such as solution pH, sorbent and Zn (II) concentrations, stirring times, foreign ions and temperature had been investigated. The sorption of Zn (II) ions onto (PMW) is described by Langmuir model. Dubinin-Radushbwich (D-R) isotherm model was also applied to describe the nature of the adsorption of the metal. Thermodynamic parameters, viz. the Gibbs free energy change (ΔG°), enthalpy (ΔH°) and entropy (ΔS°) were also calculated. These parameters indicated that the adsorption process

of Zn (II) ions on PMW was spontaneous and endothermic in nature. Under the optimum experimental conditions employed, the removal of 100% of Zn(II) ions was attained. The procedure was successfully applied to remove Zn (II) ions from aqueous and different nature water samples. The adsorption mechanism is also suggested. (54 Ref.; 3 Tab.; 12 Fig.).

44.10423

Characterization of bias magnetron sputtered tantalum oxide films for capacitors. CHANDRASEKAR (M), CHANDRA (SVJ), UTHANNA (S), (Department of Physics, Sri Venkateswara University, Tirupati – 517 502, Andhra Pradesh State, India). (Indian J. Pure Appl. Phys.; 47, 1; 2009, Jan.; 49-53).

Tantalum oxide films have been deposited by sputtering of tantalum target in an oxygen partial pressure of 2×10^{-4} mbar under various substrate bias voltages in the range from 0 to -150 V on glass and silicon substrates held at room temperature. The influence of substrate bias voltage on the chemical binding configuration, crystallographic structure, electrical and dielectric properties has been systematically studied. The X-ray photoelectron spectroscopic studies reveal that the films are stoichiometric. The X-ray diffraction and Fourier Transform Infrared(FTIR) indicate that the films deposited under unbiased condition are amorphous in nature, whereas those formed at substrate bias voltages ≥ -75 V are poly-crystalline with orthomobic α -phase. The electrical and dielectric properties of Ta₂O₅ films have been studied on the metal/insulator/metal(MIM) structure of Al/Ta₂O₅/Al. The dielectric constant of the films formed at unbiased condition has been found to be 15, while for those prepared at higher substrate bias voltage of -150V has been found to be 23 due to the improvement in the MIM structure indicate the decrease of leakage current density with the increase of substrate bias voltage. (18 Ref.; 8 Fig.).

44.10424

Sorption of phenol from aqueous solution using activated carbon prepared from *Manilkara zapoda* seed. NATH (K), THUMMAR (M), VAGHELA (M), JANI (P), (Department of Chemical Engineering, G H Patel College of Engineering & Technology, Bakrol Road, Vallabh Vidyanagar – 388 120, Anand Taluk, Kaira District, Gujarat State, India). (Indian J. Chem. Technol.; 15, 6; 2008, Nov.; 533-40).

The potential of activated carbon prepared from the seeds of *Manilkara zapota*, an agricultural waste, had been assessed for adsorptive dephenolation from aqueous solution. ZnCl₂ had been used as the activating agent. Batch adsorption experiments had been conducted to study the effect of various physicochemical parameters such as initial concentration, dose of adsorbent, initial pH and temperature. The percentage removal of phenol was found to increase with the decrease in initial concentration of phenol. Maximum removal efficiency of 96% had been achieved with 25 mg/L of initial phenol concentration at pH 4.0 and temperature 30°C. Equilibrium modeling by linearized adsorption isotherms revealed that Freundlich isotherm could well represent the observed data for phenol adsorption on activated carbon as compared to Langmuir isotherm. Thermodynamic studies revealed that the sorption of phenol by activated carbon is an endothermic

process, showing increase in sorption at higher temperature. Comparison of various kinetic models based on correlation coefficients revealed that the pseudo second order model, an indication of chemisorptions mechanism, fits better the experimental data than the pseudo first order Lagergren model. (34 Ref.; 3 Tab.; 7 Fig.).

44.10425

Investigation of acid oil as a source of biodiesel. KULKARNI (BM), PUJAR (BG0, SHANMUKHAPPA (S), (Chemistry Research Centre, Bapuji Institute of Engineering and Technology, Davangere – 577 004, Karnataka State, India). (Indian J. Chem. Technol.; 15, 5; 2008, Sep.; 467-71).

Acid oil, which is a byproduct of vegetable oil industry has been investigated for its suitability as a source of biodiesel, as it is economic and readily available in considerable quantities at most of vegetable oil refinery sites. The biodiesel from acid oil is produced by a new type of “ED3R” esterification process developed at the Institute. Fuel properties of biodiesel thus produced are compared with standard biodiesel and diesel fuel. Blends of biodiesel and diesel fuel are prepared. Fuel property variations of biodiesel blends produced are reported. (17 Ref.; 1 Tab.; 5Fig.).

44.10426

Screening and characterization of biopolymers Polyhydroxybutyrate producing bacteria. SHIVEN NAIR (S), REDDY (H), GANJEWALA (D), (Global Institute of Biotechnology, 3-6-276/2, Sai Triveni Chambers. Himayat Nagar, Hyderabad – 500 029, Andhra Pradesh State, India). (Adv. BioTech; 7, 4; 2008, Oct.; 13-6 & 18).

Four hydroxybutyrate (PHB) producing bacterial colonies had been isolated from the industrial effluents. However, only one bacterial colony among others yielded maximum PHB. Bacteria from this colony had been characterized by morphological, biochemical and molecular probes and identified as *Bacillus cereus SKC*. The maximum PHB yield had been recorded 18.7 and 8.2% (weight by weight) (w/w) dry weight basis respectively with glucose and maltose as the carbon source at pH 7.5 and temperature 400°Centigrade. However, the PHB yield varies with pH, temperature, carbon, nitrogen and phosphorous source. The PHB had been further subjected to Four Transform Infra-Red(FTIR) and Nuclear Magnetic Resonance(NMR) spectroscopy. The PHB has shown characteristic NMR spectrogram by which the two PHB produced separately in presence of glucose and maltose could be easily distinguished. (24 Ref.; 6 Fig.).

44.10427

Efficacy of 4-methyl-7-hydroxy coumarin derivatives against vectors *Aedes aegypti* and *Culex fasciatus*. DESHMUKH (M), PAWAR (P), JOSEPH (M), PHALGUNE (U), KASHALKAR (R), DESHPANDE (NR), (Department of Chemistry, Sir Parshuramkhau College, Tilak Road, Pune – 411 030, Maharashtra State, India). (Indian J. Exp. Biol.; 46, 11; 2008, Nov.; 788-92).

4-Methyl-7-hydroxy coumarin is considered as a lead molecule as a biopesticide. Its mono bromo and tribromo derivatives had been synthesized. The syntheses, of two more derivatives by acylation had been described.

Compound 1/3, 6, 8-tribromo-7-hydroxy-4-methyl-chromen-2-one) had been found to be the most potent against IVth instar larvae of *Culex quinquefasciatus* and *Aedes aegypti* the Larvicidal(LC)₅₀ being 1.49 and 2.23 parts per minute(ppm) respectively. It showed 100% larvae mortality at 25 ppm against *Aedes aegypti* and at 10 ppm against *Culex quinquefasciatus*. Compounds 1 and 2/3, 6, 8-tribromo-7-hydroxy-4-methyl-chromen-2'-oxo-2H-chromen-7-yl-acetate) had shown the remarkable ovicidal activity. Significant reduction of 8-85% hatching of eggs of both mosquito species had been observed at the highest dose of 100 ppm. The hatched larvae had shown 100% mortality in the successive instars. Compounds 3 and 4(3-bromo-7-hydroxy-4-methyl-chromen-2-one and 4 (3-bromo-7-hydroxy-4-chromen-2-one and 3-bromo-4-methyl-2'oxo-2H-chromen-7-yl acetate) had shown moderate activity against both mosquito species. (7 Ref.; 4 Tab.; 4 Fig.).

44.10428

A simple strategy to purify cyanobacterial cultures. ELANGO (V), YUVAKKUMAR (R), KANNAN (N), RAJENDRAN (V), (Centre for Nanoscience and Technology, K.S. Rangasamy College of Technology, KSR Kalvi Nagar, Thokavadi, Tiruchengode - 637 215, Tamil Nadu State, India). (Adv-BioTech; 7, 4; 2008, Oct.; 23-4).

The isolation of pure cyanobacterial culture from heterotrophic bacteria, fungi and actinonycetes contaminated culture is a difficult task. The development, of a new strategy with the employment of a double distilled and top water as a medium having the pH of 7.12 and 8.65 respectively, with a view to overcome the above task, is described. Tap water had less efficiency in this process when compared to double distilled water, was found. The cyanobacteria culture contaminated with bacterial contaminants is obtained as a pure culture through this process. (1 Tab.; 4 Photos).

44.10429

Screening and selection of efficient AM fungus for *Sorghum bicolor* and *Sorghum vulgare Pers.* RAJASEKARAN (R), MAHESH (V), MUTHUSELVAM (M), SELVARAJ (T), (Post Graduate and Research Department of Botany and Microbiology, A.Veeriya Vandayar Memorial Sri Pushpam College(Autonomous), Kudikadu, Poondi- 613 503, Thanjavur District, Tamil Nadu State, India). (Adv. BioTech; 8, 7; 2009, Jan.; 10-6).

Screening and selection of native arbuscular mycorrhizase(AM) fungus for symbiotic efficiency and higher biomass production of *Sorghum bicolor* L. and *Sorghum vulgare Pers.* were done in pot culture studies. Three indigenous Am fungi were screened for their symbiotic responses. Plants, among the tested three different AM fungi inoculated with *Glomus aggregatum* performed best in improving percent root colonization and spore count in the rhizosphere soil. Similarly plant height, root and shoot biomass, total chlorophyll content in the levels and the concentration of roots P and K in the root and shoots were significantly higher in plants inoculated with *Glomus aggregatum* when compared to other AM fungi. All these parameters were lowest in the uninoculated plants. (41 Ref.; 5 Tab.; 12 Fig.).

44.10430

Observation on the reaction rate kinetics in cellulosic paper waste. SHRIVASTAVA (R), CHAUHAN (UK), SARKAR (R), CHATTERJEE (A), (Molecular Bioscience Division, John Curtin School of Medical Research(JCSMR), Australian National University, GPO Box 334, Canberra City, ACT 2601, Australia). (Adv. BioTech; 8, 7; 2009, Jan.; 21-5).

Experimental studies were conducted to study the efficacy of the particulate size and addition of organic manure along with bacterial fungal cultures to achieve time reduction in period of composting. Shredded paper and paper pulp cellulosic waste materials which form bulk of urban solid wastes were used for purpose of biodegradation and subsequent composting. The control cow dung and M_3 culture inoculated lots were set up. Parameters of the biodegradation reaction rates have been considered hitherto as parameters to monitor the fluctuating values of biological oxygen demand(BOD) and C/N. It is felt that this usage is not prudent and instead suggested that the direct computation of reaction rates or 'K' values by graphical evaluation method. The recorded results have shown the great utility of cow dung inoculation which has increased the reaction rates at least three times. Reduction of % BOD values from 41.82 to 20.79 occurred during 32 day experimental period achieving fast reaction rates of 0.048. The M_3 inoculated lot has attained not only a higher reaction rate and BOD percentage, reduction rate but also have shown great reduction in organic carbon content from 470 mg/g to 101.5 mg/g. This observation suggest that the identification and utilization of M_3 culture as potent inoculums for extremely rapid degradation of cellulosic waste which create hazards in the rayon, pulp industry etc. due to their extremely slow biodegradation rates. Further studies in this direction are suggested for designing special treatment plants to achieve these objectives. (14 Ref.; 6 Fig.).

WOOL TECHNOLOGY

44.10431

RAM-X Stenter Machine of TIM, Turkey. NAIR (GP), PANDIAN (SP), (No.: B2/12, Technocrat Society, Twin Tower Road, Off. V.S. Marg, Prabhadevi, Mumbai – 400 025, India). (Colourage; 56, 5-Suppl.; 2009, May; 17-9).

This machine is produced for different heating purposes such as hot oil heating, steam heating, direct gas or indirect gas heating systems etc. which can be done on fabrics namely wool. This machine can be used for even dyeing of the different fabrics. (10 Fig.).

44.10432

White Classic-Mlti Layer Stenter of Unitech, Italy. NAIR (GP), PANDIAN (SP), (No. : B2/12, Technocrat Society, Twin Tower Road, Off. V.S. Marg, Prabhadevi, Mumbai – 400 025, India). (Colourage; 56, 5-Suppl.; 2009, May; 20).

This machine is suitable for processing worsted and woolen fabrics, woven and knitted fabrics. Machines, such as White P-Multi Layer Stenter of Unitech, Italy also can be used for the above purposes. (2 Ref.; 5 Fig.).

TANNERY. ENVIRONMENTAL ASPECTS

44.10433

Effect of lead on the expression of nutritional content in edible lobster, *Thenus orientalis* (Lund, 1793). KALYANARAMAN (V), SENTHIL KUMAR (P), (School of Enzymology & Environmental Toxicology, Post Graduate & Research Department of Zoology, Sir Thyagaraya College, Thondaiyar Pet High Road, Near Sambuvarayan Street and Maharani Theatre, Old Washermanpet, Chennai – 600 021, India). (Indian J. Sci. Technol.; 2, 10; 2009, Oct.; 17-22).

The edible lobster, *Thenus orientalis* is an important food of commercial interest in the parts of South India. Evaluation of toxic effect of lead on the chosen animal for the LC value and effect of heavy metal lead on the nutritional status viz. protein, carbohydrate and lipid in overy *spermatheca*, hepatopancreas, muscle and haemolymph was made. The results assume greater interest as most water bodies are increasingly subjected to environmental pressure due to pollution. (51 Ref.; 4 Tab.).

44.10434

Development of calcium alginate-gelatin based microspheres for controlled release of endosulfan as a model pesticide. ROY (A), BAJPAI (J), BAJPAI (AK), (Bose Memorial Research Laboratory, Department of Chemistry, Government Model Science College (Autonomous), Jabalpur – 482 001, Rajasthan State, India). (Indian J. Chem. Technol.; 16, 5; 2009, Sep.; 388-95).

Controlled release formulations have been developed by encapsulating endosulfan for reducing environmental impact of pesticides within the macromolecular network of calcium alginate and gelatin based microspheres. Various alginate and gelatin based composition were prepared by crosslinking sodium alginate with calcium ions in the presence of gelatin. The effects of preparation conditions of beads such as varying concentrations of crosslinker, endosulfan, alginate to gelatin ratio and temperature were investigated on the release profiles of endosulfan. The obtained release data were analyzed in accordance with Ficks power law and kinetic parameters of the release process were calculated. The results obtained demonstrate that one can significantly and desirably control the rate of pesticide release by suitably modifying and adjusting the experimental protocol. The soil-pot experiments were also performed to predict the kind of mechanisms which the endosulfan may follow while being released in the agricultural fields. (35 Ref.; 3 Tab.; 5 Fig.).

44.10435

A study on expulsion of cadmium(II) and chromium(III) from electroplating effluent. SATHYASELVABALA (V), PANNEERSELVAM (P), ARULMOZHI (R), THIRUVENGADARAVI (KV), THINAKARAN (N), SIVANESAN (S), (Environmental Management Laboratory, Department of Chemical Engineering, A.C. Technology College, Anna University, Sardar Vallabhai Patel Rod, Guindy, Chennai – 600 025, India). (Indian J. Sci. Technol.; 2, 11; 2009, Nov.; 27-31).

Chromium and cadmium are toxic heavy metals present in wastewater from electroplating industries. The removal of Cd(II) and Cr(III) by Amberjet, IR 1200, a synthetic ion exchange resin has been studied. The resin was prepared into two cationic forms H⁺ and Na⁺. The optimum conditions were concentration, pH, stirring time and resin amount. The exchange capacities, moisture content and optimum speed was 50 parts per minute(ppm) during all the batch experiments. The initial and final chromium and cadmium amounts were determined using the atomic absorption spectroscopy. The most preferable values of concentration is 10 mg/L; pH is 5.5, stirring time 30 minutes, amount of resin 200 mg. The maximum removal and recovery for Cd(II) and Cr(III) was seen in Na⁺ form of resin. (26 Ref.; 3 Tab.; 5 Fig.).

44.10436

GIS based microlevel approach for hydrogeochemical studies in upper Manimuktha sub basin, Vellar, South India. GURUGNANAM (B), SURESH (M), VINOTH (M), PRABHAKARAN (N), KUMARAVEL (S), (Department of Earth Sciences, Annamalai University, Annamalai Nagar, Chidambaram – 608 002, Tamil Nadu State, India). (Indian J. Sci. Technol.; 2, 11; 2009, Nov.; 5-10).

Groundwater chemical quality studies were carried out in upper Manimuktha sub basin, Vellar, South India. Fifty two groundwater samples were collected from dug and bore well during pre and post monsoon seasons of 2006. The samples were analyzed for various water quality parameters such as pH, Electric Conductivity, Total dissolved solids, Calcium, Magnesium, Sodium, Potassium, Biocarbonate, Carbonate, Sulphate and Chloride. The results were evaluated in detail and compared with World Health Organization(WHO) water quality standards. An overall assessment of the water samples indicated that the physic and chemical parameters are lies within the permissible limit except in some locations. It is inferred from Riper trilinear diagram that the water is mostly of alkaline earth exceeds alkalis. Gibbs diagram reveals that the overall hydrogeochemical environment of the study area is controlled by the rock water interaction dominance. It falls under C₃-S₁ category according to the United States Salinity Laboratory(USSL) classification of water quality. These results are taken into GIS platform for further processing to understand the spatial variation. Finally, the quality variation is brought out at village level. (14 Ref.; 6 Tab.; 10 Fig.).

44.10437

Linking green supply chain management and shareholder value creation. SEN (S), (IBS WIC Building, J3, Block GP, Sector-V, Salt Lake City, Kolkata – 700 091, India). (ICFAI Univ. J. Supply Chain Manage.; 6, 3 & 4; 2009, Sep. & Dec.; 95-109).

Some, of the causes, of global warming and its consequences, are reviewed. Green Supply Chain Management(GrSCM) as one of the most effective ways to reduce pollution and waste, which represent incomplete and ineffective utilization of resources or inefficient conversion processes, is identified. Deterioration of the environment and excess consumption of resources have put increasing pressure on corporate operating in emerging makers. The biggest concern facing corporate today is how to reduce or eliminate adverse envi-

ronmental impacts of their products and pressures throughout their life cycle. Resources, committed and utilized for GrSCM need to be looked upon as long-term strategic investments and not merely as cost centers, are suggested. In fact, an attempt is made to bring out its bearing on enhancing shareholder value. A support is given to the emerging paradigm that investment in GrSCM and corporate performance need not be mutually exclusive and dichotomous. GrSCM strategies adopted by Reliance Industries is tracked down and an assessment of its linkage with the organization's Price Earning(P/E) ratio and ultimately in creating value for its shareholders, is attempted. GrSCM, which not only contributes positively to Corporate Social Responsibility(CSR), but also generate exceptional value for its shareholders, is proposed. Therefore, it encourages corporate to shed their myopic view and become early adopters of GrSCM. (10 Ref.; 3 Tab.).

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Detection of water-borne pathogens : culture plate to genomics. DIXIT (U), SHANKER (R), (Science & Society Division, Department of Science & Technology (DST), Technology Bhawan, New Mehrauli Road, New Delhi – 110 016, India). (Indian J. Sci. Technol.; 2, 11; 2009, Nov.; 59-71).

The use, of different analytical techniques for detection of water borne pathogens, is described. The brief information, about the development of new diagnostic and monitoring techniques, is discussed and its important role, in risk management of water related diseases, is explained. New techniques aid development of strongly early warning systems, reliable field diagnostics, treatments and more effective remediation of impacts from harmful microorganisms. The future developments in signal detection are proposed and miniaturization technologies provide real-time monitoring and diagnostics for rapid assessment of microbial pathogens. (113 Ref.; 5 Tab.; 5 Fig.).

LEATHER PRODUCTS

FOOTWEAR

44.10439

Indonesia. (Leather Age; 31, 7; 2009, Jun.; 33-7).

The predominant roles, that are being played by both the leather and footwear industries in the Indonesian economy have been described.

44.10440

Triggering the in-pulse. BANERJEE (S), (Shoe Accessor.; 2, 5; 2010, May; 71-3).

The types of role that impulses the shopping playing in the footwear and accessory categories, is questioned. The strategies, adopted by retailers to seduce customers into unplanned buys, are probed. (4 Photos).

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