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# JILTA

## Journal of Indian Leather Technologists' Association

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# XXXIV IULTCS Congress Special Issue

Indian Leather Technologists' Association

Central Leather Research Institute

IULTCS 2017
INDIA

XXXIV IULTCS CONGRESS

5-8 February 2017, CSIR-CLRI, Chennai, India

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Council for Leather Exports

Indian Finished Leather Manufacturers & Exporters Association

# Indian Leather Technologists' Association

**[A Member Society of International Union of Leather Technologists' and Chemists Societies (IULTCS)]**

'SANJOY BHAVAN', 3rd Floor, 44, Shanti Pally, Kasba, Kolkata – 700 107
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## Mission & Vision

- An Association with over 600 members from India and abroad working since last 64 years for the growth and development of Leather and its allied industries.
- Organize seminars, symposiums, workshops in order to share information, knowledge & latest development and interactions for the benefit of all concerned.
- Organize Human Resource Development programmes on regular basis.
- Publish for over 60 years, a technical monthly journal namely "Journal of Indian Leather Technologists' Association" (JILTA), widely circulated through out the World.
- Publish books for the benefit of the students at various levels of study, for the Research Scholar and the Industry.
- Work as interface between Industry and the Government.
- Assist Planning Commission, various Government Institutions, Ministry and autonomous bodies to formulate appropriate policies for the growth of the Industry.
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# JOURNAL OF INDIAN LEATHER TECHNOLOGISTS' ASSOCIATION (JILTA)

Indian Leather Technologists' Association is a premier organisation of its kind in India was established in 1950 by Late Prof. B.M.Das. It is a Member Society of International Union of Leather Technologists & Chemists Societies (IULTCS), Geneva, Switzerland.

The Journal of Indian Leather Technologists' Association (JILTA) is a monthly publication which encapsulates latest state of the art in processing technology of leather and its products, commerce and economics, research & development, news & views of the industry etc. It reaches to the Leather / Footwear Technologists and the decision makers all over the country and overseas.

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# INDIAN LEATHER TECHNOLOGISTS' ASSOCIATION

(Member Society of International Union of Leather Technologists and Chemists Societies)

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# JOURNAL OF INDIAN LEATHER TECHNOLOGISTS' ASSOCIATION (JILTA)

## XXXIV IULTCS Congress – Kumbh Mela for Leather world!

What to term the XXXIV IULTCS Congress! Is it a congress! Or congregation! Or colosseum!

It was a congress as well as congregation and ultimate colosseum in the evening. The world of technocrats and chemists congregated here with the sense of utmost religiousness for their beloved leather world. They spoke, shared and above all realised each other for global sustainability. The only term 'passion' prevailed over 'profession' during the days of happenings.

The International Union of Leather Technologists and Chemists Societies is holistically performing the task to encourage and develop interchange of knowledge and experience between leather technologists and chemists worldwide by increasing the collaboration between member societies.

Their Indian affiliate - Indian Leather Technologists Association (ILTA) and CSIR-Central Leather Research Institute (CLRI) jointly organized the XXXIV IULTCS Congress during 5-8 February 2017 in Chennai at ITC Grand Chola.

The spectrum of discussion this year was centred on the following theme:

- Fundamentals in leather science
- Strategies for sustainability
- Innovation and value addition for leather
- Advances in chemicals for smart and intelligent leathers
- Design innovation for lifestyle leather products
- Emission control technologies
- Enriching human capacity
- Global research alliances and partnerships

The 34th IULTCS Congress was inaugurated today with the ceremonial parade at the Rajendra Hall, ITC Grand Chola, Chennai. As the IULTCS anthem began playing, Dr Dietrich Tegtmeyer (President-IULTCS), carrying the IULTCS flag led, the procession of celebrities comprising Dr. T. Ramasami (Congress President), Shri Rafeeque Ahmed (Chief Patron), Shri Mukhtarul Amin, Shri Aqeel Ahmed, Shri Shafeeq Ahmed, Shri M Israr Ahmed (Guests of Honor), Dr B Chandrasekaran, Director CSIR-CLRI, Shri Arnab Jha, President ILTA, Dr Campbell Page, Secretary IULTCS, Dr S Rajamani, Working President, 34th IULTCS, Shri NR Jagannathan, Working President, 34th IULTCS and Dr N K Chandrababu, Congress Convenor, 34th IULTCS, into the Hall amidst a rousing ovation. The gathering was greeted by Dr. B. Chandrasekaran, director, CLRI. His warm words of welcome were followed by the lighting of the 'Kuthuvilakku' (Indian traditional lamp) by the dignitaries on the dais. This set the pace for the events to begin. The first was the play-back of the video recordings, the inspiring messages about the Congress by each of the above dignitaries. Dr. Dietrich Tegtmeyer, Dr Campbell Page and Shri Ramesh Kumar, IAS added great value and thrust with their live speeches. Dr. Dietrich Tegtmeyer later introduced Dr Mariliz Gutterres, IULTCS merit awardee followed by the latter's speech of acceptance. At end, Shri Arnab Jha proposed vote of thanks. The ceremonial inauguration concluded with the national anthem. The inauguration was followed by three days of brilliantly organised programme orchestrated seamlessly by the organisers. Cultural evenings on first and second day of the mega event introduced the vibrant Indian culture to our global fraternity. Thus, scientific forum discussing on a serious issue of 'sustainability' got a soothing abode in Indian culture and philosophy.

The grandeur, discipline and the theme 'Feel India' blended together transformed the mega event to a newer orbit. Science, culture and philosophy reinforced the threads of triple helix further. The unequivocal confession from all participants regarding our next mission for greener leather world got the fraternity throng under an umbrella. We are thankful to ILTA and CSIR – CLRI for presenting the global leather fraternity such a splendid and commendable programme. I would like to reserve gracious gratitude for President, ILTA and Director, CSIR CLRI for their extreme personal care and initiative for presenting such ultra professional global gift yet Indianised in every aspect to the leather world.

I would like to pay regards and gratitude to all who have joined hands together in front of /behind the veil to present the international leather arena as well as India in a so beautified package so that it has become a benchmark by itself.

We will like to share glimpses of the mega event in our following pages with all well wishers of JILTA who could not make themselves available for the event.

We would like to dedicate this issue of JILTA for the event which is going to be memorised long.

Goutam Mukherjee

***Goutam Mukherjee***
Hony. Editor, JILTA

# XXXIV IULTCS Congress

## "Science and Technology for Sustainability of Leather"

### M E S S A G E
**(Post - Happening)**

**Dear Global Leather Fraternity,**

The nostalgia of 34th congress is only a phenomenon of few days back. This congress happened to be special in terms of its vibrant quality, type of participation and depth of topics discussed on sustainability of leather society. I would like to give sincerest thanks from my desk to the every member of our organizing committee for the splendid phenomenal congress presented to the global forum. We had three busy and extensive involvement incurring days for looking at each other, listening to each other, sharing with each other, exchanging with each other and ultimately cozying with each other. The philosophy of this year's congress turned the leather world into a leather village where everybody transposed their facultative coordinates and recalibrated. All the participants were duly introduced to vibrant Indian culture.

Indian Leather Technologists Association and Central Leather Research Institute by working closely with all segments of the Indian Leather industry has put together a wonderful conference taking every step to make the occasion memorable and enjoyable.

Let me pay heartfelt regards to the Apex Body of Leather chemists, technologists and Professionals of leather world (IULTCS) for their unifying and ever sustaining effort in serving the cause of leather world.

Thanks and sincerest regards to all involved in IULTCS 2017.

**Susanta Mallick**
Genl. Secretary – ILTA

## XXXIV IULTCS Congress

### "Science and Technology for Sustainability of Leather"

**M E S S A G E**
**(Pre - Happening)**

On behalf of the IULTCS 2017 Congress Organizing Committee and as the Director of CSIR-Central Leather Research Institute, I am honoured and de- lighted to welcome you all to the 34th edition of IULTCS Congress at Chennai, India. We join hands with Indian Leather Technologists' Association (ILTA) for the second time after 1999 to organize this mega event along with fraternal support from Indian and Global leather industries.

The Congress has intense technical programs with 6 keynote speeches, 42 oral and about 200 visual presentations spanning through 8 sessions over a period of two and a half days. Besides, a popular lecture and Prof. Heidemann lecture will add more vibrancy to the participants. There will be plenty of opportunities for making connections between peers.

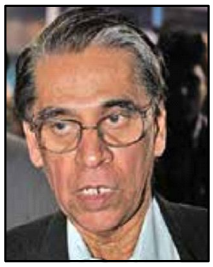
While the Congress aims to address the technological challenges towards sustaining the leather manufacturing activity, key points such as raw material availability and ensuring low environmental footprints from the industry will also be deliberated. CSIR-CLRI would like to take lead in forming global alliance with the stakeholders of all leather and product manufacturing countries towards sustainable development of the Sector.

On behalf of the Organizing Committee and on my own behalf, I extend wishes for a rewarding experience and a memorable stay at Chennai

**Dr. B. Chandrasekaran**
Director, CSIR- CLRI

# XXXIV IULTCS Congress

## "Science and Technology for Sustainability of Leather"



### M E S S A G E
**(Pre - Happening)**

**A Hearty message from a die-hard Leather Chemist**

As the President of the Congress of International Union of Leather Chemists and Technologists, it is pleasurable privilege and honorable duty to invite every one of the members of the Global leather fraternity attending the session at Chennai, a leather land part of the world in February 2017. The congress is promising to be a special one on account of the quality and the type of participation and the vastness of the nature of topics planned to be discussed on Science and Technology sustainability of leather processing. Indian Leather Technologists Association and Central Leather Research Institute by working Closely with all arms of the Indian Leather industry has strived to put together a wonderful conference taking every step to make the occasion memorable and enjoyable. Let me extent hearty welcome every sister, brother and member of the family of International leather world on behalf of the Indian leather sector and wish the congress a resounding success. Let me salute the Apex Body of Leather chemists, technologists and Professionals of leather world (IULTCS) for their unifying effort in serving the cause of leather world. Let the congress of 2017 pave a way for science lead way for sustainability of leather processing in the only planet that the humanity has known to survive and prosper in. Thank you and best regards to all.

**Dr. T. Ramasami**
President, XXXIV IULTCS Congress
Former Secretary to the Government of India
Ministry of Science and Technology, New Delhi &
Member of ABEO, Organization for the Prohibition of
Chemical Weapons The Hague, The Netherlands
Honorary Professor Indian Institutes of Science Education
and Research, Mohali and Kolkata, India
dstsec@yahoo.co.in and samisrisailam@gmail.com

# XXXIV IULTCS Congress

## "Science and Technology for Sustainability of Leather"

### M E S S A G E
**(Pre - Happening)**

**Dear Friends of Leather World!**

It is a great pleasure and honor to extend to you a warm invitation to attend the 34th International Union of Leather Technologists & Chemists (IULTCS) Congress, to be held at Chennai, India for the second time between February 5 and 8, 2017. I believe we have been chosen as organizers to guarantee a successful technical conference amid the culture and scenery of Chennai. The 2017 Conference is jointly organized by CSIR- Central Leather Research Institute (CSIR-CLRI) and Indian Leather Technologists Association (ILTA). Our scientific program is rich and varied with keynote speeches, several oral and poster presentations and a public lecture. We also expect to provide few technical demonstrations and numerous opportunities for informal networking.

As a member of organizing committee, I know that the success of the conference depends ultimately on many people who have worked with us in planning and organizing both the technical program and supporting social arrangements. In particular, we thank the Program Chair for brilliantly organizing the technical program; the Scientific Committee for their thorough and timely reviewing of the papers, and our sponsors who have helped us to keep down the costs of IULTCS 2017 for all participants. Recognition should go to the Local Organizing Committee members who have all worked extremely hard for the details of important aspects of the conference programs and social activities.

We hope you will join us for a symphony of outstanding science, and take a little extra time to enjoy the spectacular and unique beauty of this region.

With best wishes,

**Shri NR Jaganathan**
President, ILTA (South)

# From the Desk of General Secretary

**A. XXXIV IULTCS Congress**

Detailed report of the above, organized jointly by ILTA and CLRI at Chennai from 5th to 8th February' 2017 appears under "Commentaries" section and Photographs & Day-to-Day Reports of the event appears under "IULTCS – 2017" section of this issue.

**B. LEXPO – XXXX at Kolkata :**

As far back as in September, 2016, we were allocated Geetanjali Stadium from 4th to 19th February for organizing LEXPO – XXXX. Accordingly we paid thedemanded ground rent on 27.01.2017 we were subsequently informed verbally by the competent authority that the schedule was likely to change to a 18th February to 4th March, 2017 which we intimated to our Members through February'2017 issue of JILTA.

Subsequent development was that this revised schedule was also changed by the competent authority due to last minute urgent requirement of the venue by the Govt.

The confirmed schedule of LEXPO – XXXX is now from 11th to 26th March, 2017. The inaugural ceremony is scheduled to take place at the Geetanjali Stadium on Saturday the 11th March, 2017 at 05.30 PM.

Mr. Firhad Hakim, Hon'ble Minister – in – Charge, Municipal Affairs & Urban Development Deptt., Govt. of West Bengal has been approached to grace the Inaugural Ceremony as the Chief Guest and inaugurate the fair. Mrs. Asima Patra, Hon'ble Minister – in – Charge, Technical Education & Training & Skill Development Deptt., Govt. of West Bengal has been approached to kindly grace the occasion as the Guest of Honour.

All our Members are most cordially invited. The fair will remain open from 03.00 PM to 09.00 PM everyday during the fair period up to 26th March, 2017.

**C. LEXPO – XXIII at Siliguri :**

Confirmed dates of LEXPO at Siliguri is from 1st to 16th April, 2017 as intimated through February' 2017 issue of JILTA. The Inaugural Ceremony is scheduled at 05.00 PM on Friday the 31st March, 2017.

**D. 6th Moni Banerjee Memorial Lecture**

This will be held on Wednesday the 15th March, 2017 at 03.00 PM at the auditorium of Indian Science Congress Association, 14, Dr. Biresh Guha Street, Kolkata – 700 017. Registration will start from 02.00 PM. All are most cordially invited to participate. Individual invitation cards have been posted on 04.02.2017.

Mr. Avijit Dutta, an eminent leather finisher has kindly consented to deliver the Memorial Lecture titled **"Techniques of Finishing of Upholstery Leather – Furniture vis-à-vis Automotive"**.

**E. Condolence Meeting – Late Debansu Dasgupta :**

A condolence meeting to pay respect to the departed souls of Debansu Dasgupta & Pankaj Bhowmick was organized jointly by ILTA & Alumni Association, GCELT at 05.30 PM on Tuesday 28th February, 2017 at the conference room of GCELT.

## BEREAVEMENT

With profound grief and a heavy heart we announce the sad demise of Pankaj Bhowmick, a Life Member of ILTA on 24.02.2017.
May his soul rest in peace and May God give strength to the Members of the Bereaved family to bear the irreparable loss.

**You are requested to :-**

a) Kindly inform us your '**E-Mail ID**', '**Mobile No**', '**Phone No**', through E-Mail ID: admin@iltaonleather.org or over Telephone Nos. : 24413459 / 3429 / 7320. This will help us to communicate you directly without help of any outsiders like Postal Department / Courier etc.

b) Kindly mention your **Membership No. (If any)** against your each and every communication, so that we can locate you easily in our record.

**(Susanta Mallick)**
General Secretary

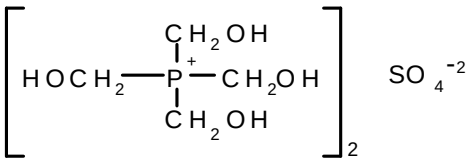
**Executive Committee Members meet every Thursday at 18-30 hrs. at ILTA Office.**
**Members willing to participate are most welcome.**

# Fifty Years of Tanning with Tetrakishydroxymethyl Phosphonium Compounds (THPX)

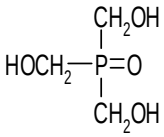
**Dr. Samir Dasgupta**, PhD, FSLTC, New Zealand

## 1.0 Introduction

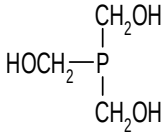
The action of organophosphonium compounds in particular tetrakishydroxymethyl chloride (THPC) on hide protein was first studied and patented by Filachione in 1956[1]. He claimed that THPC tans best near the isoelectric point of the hide (pH 4 – 6) and a very small amount of THPC is required for an optimum tannage. He suggested that in alkaline solutions THPC is converted to tris (hydroxymethyl) phophine oxide (THPO) and this converted THPO might be the active tanning agent in an alkaline pH. Later in 1959, Picklesimer[2] patented a process for the production of leather with THPO. In the same year, Windus, Filachione and Happich patented a similar process of tanning with THPC and phenol. The leather from this tannage had a shrinkage temperature of 80 – 85°C but was thin and firm. They recommended a starting pH of 4.0 – 4.5 with a gradual increase during tannage to pH 8.5 – 9.0 for the optimum tannage. Windus and Happich extended their work with THPC and published results of their *in situ* tannages using THPC and resorcinol to obtain better quality leather with a shrinkage temperature of 92°C. They also reported that domestic (US) sheep skin leather tanned with 3.75% THPC alone was not resistant to perspiration but leather tanned with 3.75% THPC and 2% resorcinol possessed excellent perspiration resistance. They claimed that New Zealand sheep skin tanned with as little as 0.87% THPC and 0.5% resorcinol passed the perspiration test with only slight area loss, discolouration and a moderate increase in stiffness. Jenkins and Wolfram investigated the chemistry of the reaction between THPC and keratin, and concluded that the reducing action of aqueous solutions of THPC is due to a tertiary phosphine – trishydroxymethyl phosphine (THP), one of the products of THPC dissociation. Wolfram verified this postulation and established THP as one of the most potent reducing agents for keratin. The structure of some important organophosphonium compounds are given aside :



Tetrakishydroxymethyl phosphonium sulphate (THPS)



THPO
Trishydroxymethylphosphine oxide



THP
Trishydroxymethylphosphine

At low pH THPS or THPC have a positive charge and no tanning ability. As the pH is raised THPS forms reactive compounds that cross-link with proteins to tan the skin. Windus and Happich had proposed a mechanism for tanning but this does not account for the Tetrakishydroxymethyl phosphine oxide (THPO) and Tetrakishydroxymethyl phosphine (THP) formed in solution as pH is raised.

However, there is not much published information about the action of tetrakishydroxymethyl phosphonium sulphate (THPS) on hides and skins. In a New Zealand patent, Albright and Wilson claimed the use of one or more tetrakis (hydroxy) phosphine (THP) salts of the formula THPX, where X is an anion such that the salt is soluble in water, for the application to hide and skin or leather for pretanning and finishing operations. The results of comparative trials on degreasing of lambskins against glutaraldehyde and Oxazolidine A were also reported[9]. Covington and Ma reported that a combination of THPS and melamine formaldehyde resin could provide leather with a shrinkage temperature above 100°C. Allsop and Dasgupta showed the effect of THPS and its derivaties on

Correponding Author's E-mail : dr.dasgupta.samir@gmail.com

tanning. Dasgupta studied the various aspects of tanning and its effect on the properties of leather for chrome free leather. This could be a real break through in chrome free tannages of leather.

Therefore, attempts have been made here to explain clearly some basic factors that are responsible for the tanning action of THPS and tries to indicate the development of tanning with THPX over the last fifty years.

**2.0 History of the developments of THPX Tannages:**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## 3.0 Some Basic Facts of THPX Tannages:

**3.1** Most recent studies were done with Tetrakis hydroxymethyl phosphonium sulphate (THPS), a 75% solution, supplied as Albrite AD by Albright & Wilson.

### 3.2 Effect of THPS concentration, initial pH and temperature

Delimed skin pieces was pickled to various pH levels (1.5, 2.5, 4.5, 6.5 and 8.5) and treated with different application levels of THPS (1.0, 1.5 and 2%) at either 15°C or at 40°C for 4 hours. Samples were taken at 1 hour intervals for determination of shrinkage temperatures, following IULTC method. Progress of THPS penetration was also monitored using a spot test. After 4 hours the exhaust tanning bath was analysed for residual THPS and its derivatives. The skins pieces were then washed at 40°C for 15 minutes and shrinkage temperature remeasured. The linear shrinkage of the strips was measured in relation to initially determined dimensions.

The effects of pickle pH (1.5, 2.5, 4.5, 6.5 and 8.5) and different application levels of THPS (1.0, 1.5 and 2%) at either 15°C or at 40°C for 4 hours on the shrinkage temperature of lambskins are shown in Figure 1.

**Figure 1a: Effect of pH on shrinkage temperature of lamb skin, tanned at 15°C**

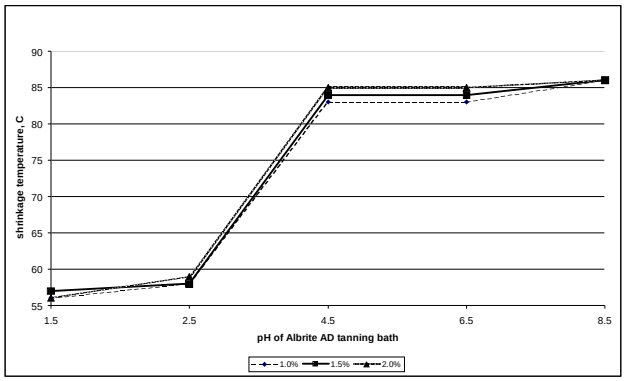
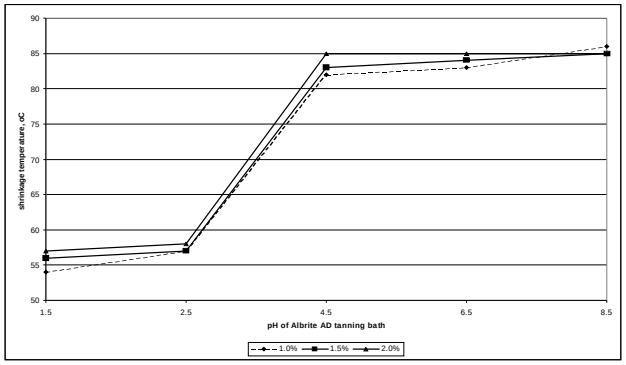



**Figure 1b: Effect of pH on shrinkage temperature of lamb skin, tanned at 40°C**




The results showed that temperature has not much effect on the final shrinkage temperature of the skin but the pH has a dominating effect. Tanning takes place between pH 4.5 to 6.5; the optimum shrinkage temperature of 83 – 85°C, obtained at 4.5 remained almost constant at higher pH 6.5 or 8.5. This reinforces the observations of Filachione[1] on the tannage of hides with THPC. In this context, it is very interesting to note his remark that "at lower pH values tannage is considerably slower while at higher values some of the THPC may be lost through reaction with alkaline reagent. Faster tannage is obtained at elevated temperature. Even at ordinary room temperature, however, very rapid tannage is obtained so that usually there is little advantage in applying heat to the tanning bath. Even at 15 – 20°C, tannage is usually complete in 1 – 2 hours".

### *3.3 Effect of concentration and time on the shrinkage temperature*

*The results are shown in Figures 2a to 2e.*

**Fig 2a: Effect of concentration and time on the shrinkage temperature at pH 1.5**

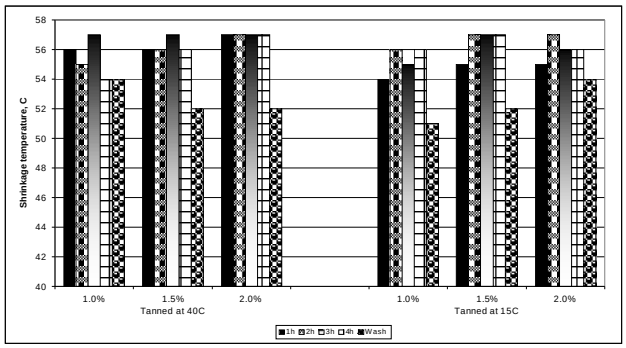



**Fig 2b: Effect of concentration and time on the shrinkage temperature at pH 2.5**

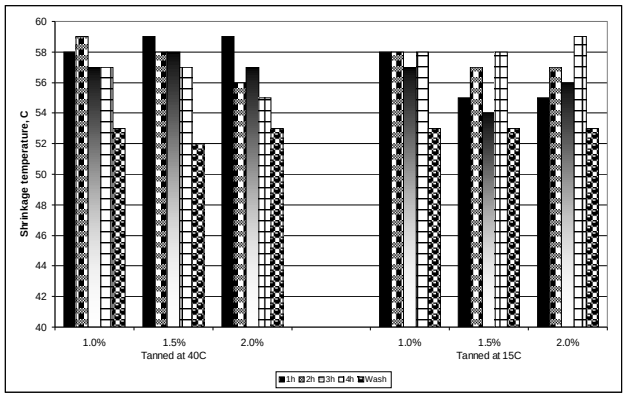



**Fig 2c: Effect of concentration and time on the shrinkage temperature at pH 4.5**

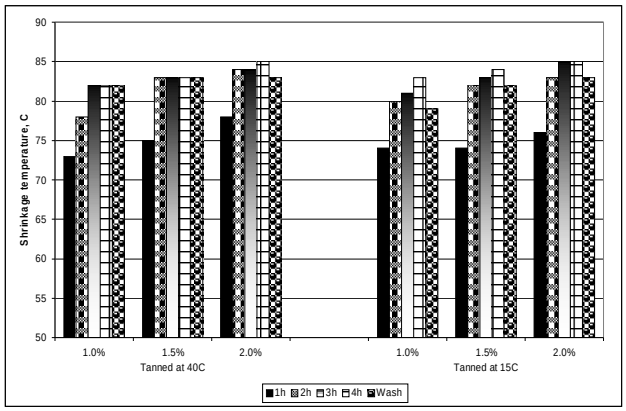


**Fig 2d: Effect of concentration and time on the shrinkage temperature at pH 6.5**

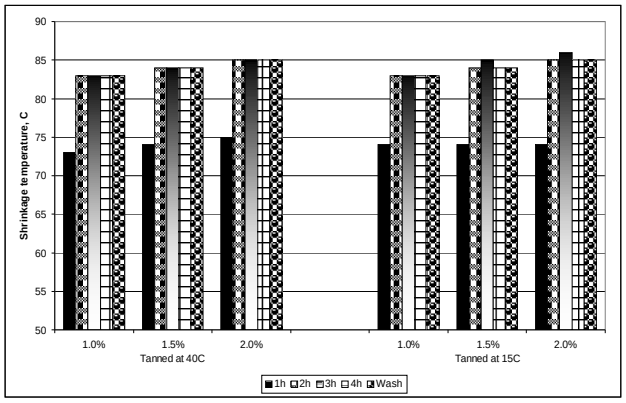
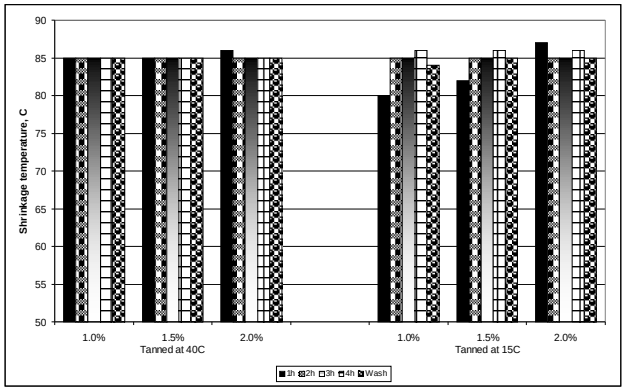



**Fig 2e: Effect of concentration and time on the shrinkage temperature at pH 8.5**



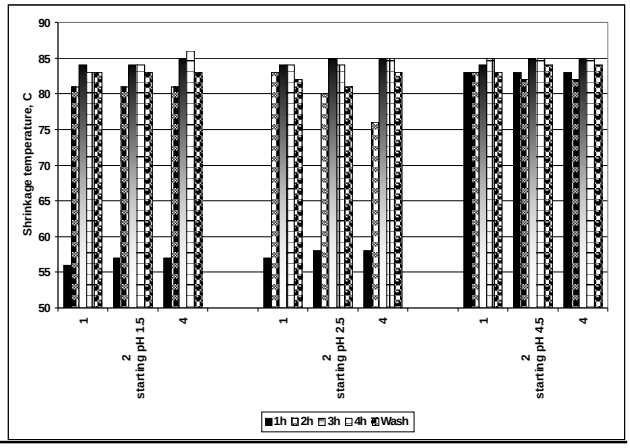

It is clear from the figures that at pH below 2.5, there is no tanning and simple washing reduced even the nominal increase in shrinkage temperature back to the original. Tanning took place at about pH 4.0 – 4.5 and a shrinkage temperature of 80 – 85°C is reached within 1 – 2 hours. This shrinkage temperature remained almost constant even at pH 6.5 and 8.5. The penetration of THPS was complete within an hour as indicated by the selenium indicator for pelts treated at pH 4.0 and above. As this indicator remained colourless at pH below 2.5, the penetration of THPS at pH 1.5 and 2.5 could not be confirmed.

### 3.4 Effect of the rate of pH adjustment

Delimed skin pieces were pickled to pH levels of 1.5, 2.5 and 4.5 and treated with 1.5% THPS and the pH of the tanning bath was raised after an hour by addition of sodium formate and sodium carbonate to pH 6.5 – 7.0 either by a single addition, by two additions 30 min apart or by 4 additions at 15 minutes intervals. Tanning was continued for 4 hours. Shrinkage temperature and THPS concentration of the residual exhaust liquor were monitored. The stability of the pretannage to a single post tanning wash, the dimensional stability of the pretanned skin pieces was also measured. Based on results of the small scale experiments, two dozen pickled lamb skins were taken and divided at random into two groups. One group was depickled to pH 4.0 – 4.5 and the other kept at the normal pickle pH of 1.2 – 1.5. These groups were then degreased and pretanned with 4% degreasing agent B and 1.5% THPS, gradually adjusting the final pH to 6.2 – 6.5 with sodium formate and sodium bicarbonate in the normal manner. The shrinkage temperature of skin at each stage was determined. The area of the skin was also determined at pickled, pretanned, wet blue and crust stages. All physical properties were also determined to assess the effect of two different initial pH conditions on the quality and area yield of the final leather.

When the pH of the tanning bath was raised to pH 6.5 -7.0 by a single addition, or by two additions or by four additions, the shrinkage temperature of pieces at pH 1.5 and 2.5 increased gradually and reached a maximum in 3 hours whereas those started at pH 4.5 reached the same maximum within 2 hours. The final shrinkage temperature remained around 83 – 85°C, irrespective of the initial pH as shown in Figure 12.

**Fig 3: Effect of number of alkali addition steps on the shrinkage temperature of lamb skins**



The results of small scale trials as shown in Table 1 gave an indication that linear shrinkage was higher when tanning was initiated at lower pH (1.5 and 2.5) than that obtained when tanning was started at pH 4.5.

**Table 1a: Effect of steps of addition of alkali on the linear shrinkage of lamb skins**

| No. of addition | Linear shrinkage (% of pickle pelt) | | |
|---|---|---|---|
| | pH 1.5 | pH 2.5 | pH 4.5 |
| 1 | 7.9 | 5.0 | 3.3 |
| 2 | 8.7 | 6.0 | 3.6 |
| 4 | 7.3 | 6.2 | 5.3 |

Twelve half-skin matched pair trials again indicated as shown in Table 1b that starting tanning at pH 4.0 might give an increased area yield.

**Table 1b: Effect of starting pH on the area yield of lamb skin**

| Initial pH | Area as % of original pickle pelt area | |
|---|---|---|
| | Wet blue avg | Crust avg |
| 1.44 | 93.2 | 88.1 |
| 4.15 | 96.0 | 90.2 |

The THPS in the exhaust bath and fat content of the leather were similar as can be seen in Table 2.

**Table 2: THPS in exhaust and fat content in wet blue***

| | THPS in exhaust (ppm) | Fat content (%) | Free fatty acid (%) |
|---|---|---|---|
| 1.44 | 657 | 3.25 | 0.21 |
| 4.15 | 541 | 3.20 | 0.20 |

* moisture free basis

However when this experiment was scaled up with one dozen Lambskins each at pH 1.25 and pH 4.15, the results as given in Table 3, showed no significant difference between the two systems of pretanning with 1.5% THPS. The THPS in the exhaust tanning baths was also similar; 638 ppm and 686 ppm for the starting pH 1.25 and pH 4.15 respectively. It was interesting to observe while adjusting the pH of the tanning bath from pH 1.25 to pH 6.5, the colour of the float turned pink at first around pH 3.0 and then changed to yellowish around pH 4.0, suggesting some form of transformation of THPS.

**Table 3: Effect of gradual addition of alkali on the area yield of lamb skin**

| Initial pH | Area, as % of original pickle pelt area | | | | | |
|---|---|---|---|---|---|---|
| | THPS pretan | | Wet blue | | Crust | |
| | Avg | SD | Avg | SD | Avg | SD |
| 1.25 | 95.2 | 1.6 | 96.6 | 2.1 | 89.7 | 4.1 |
| 4.15 | 95.2 | 1.4 | 95.3 | 1.9 | 89.3 | 3.5 |

* Difference not significant ($p > 0.05$)

The physical properties of the two trial sets are not significantly different as seen from the results given in Table 4.

**Table 4: Physical properties of crust lamb skins**

| | Initial pH | | | |
|---|---|---|---|---|
| | pH 1.25 – 1.5 | | pH 4.0 – 4.5 | |
| | Avg | SD | Avg | SD |
| Thickness, mm | 1.16 | | 1.16 | |
| Grain strength | | | | |
| (a) Load at grain crack, kg | 36.6 | 6.8 | 34.3 | 7.4 |
| (b) Distension at grain crack, mm | 9.7 | 0.5 | 9.9 | 0.6 |
| Tear strength, N/mm | 38.8 | 3.0 | 36.7 | 5.2 |
| Tensile strength, $N/mm^2$ | 17.5 | 4.0 | 17.7 | 4.7 |
| Elongation at break, % | 47.7 | 4.8 | 46.1 | 7.3 |
| Softness, BLC value | 4.7 | 0.5 | 4.7 | 0.6 |

* Difference in values are not significant ($p > 0.05$)

Therefore, tanning may be started at a pH around 4 to reach the optimum shrinkage temperature in a shorter period for aqueous degreasing, without any adverse effect on the leather quality.

### 3.5 Effect of reacidification conditions on pretannage stability

Three matched pairs of THPS pretanned and

aqueous degreased (4% degreasing agent B) half skins, cut through the backbone was randomly divided into two sets. One set was treated with sulphuric acid and other with formic acid in a brine bath (100% water, 6% salt) to bring down the pH to around pH 3.0. The skins were then chrome tanned and crusted out following a standard process. The area of the skins were measured after pretanning and at the wet blue and crust stages to determine any effect of the acid on the area yield of the final leather. All physical tests were also conducted on these three matched pairs. The colour of matched pairs of wet blue, pretanned with THPS, and treated with sulphuric acid or formic acid in a brine bath (100% water, 6% salt) to bring down the pH to around pH 3.0 were different. The formic acid treated skins were of normal masked chrome colour whereas sulphuric acid gave a greener colour and looked like an unmasked chrome tan colour. When crusted and dyed together, these differences were maintained as shown by the results of comparative colour measurements given in Table 5.

**Table 5: Effect of different acids on colour of crust lamb skins (all colour values are against White Tile standard)**

| Colour values | Formic acid | | Sulphuric acid | | Significant difference |
|---|---|---|---|---|---|
| | Avg | SD | Avg | SD | |
| L* | 51.57 | 1.30 | 52.37 | 1.31 | none |
| a* | - 3.96 | 0.04 | - 4.08 | 0.08 | yes – greener with sulphuric |
| b* | - 7.70 | 0.38 | - 7.35 | 0.57 | none |
| ΔE | 45.13 | 1.33 | 44.35 | 1.32 | none |

The area yield of the leather given in Table 6 indicates some differences but these are not statistically significant. A large scale trial is necessary to confirm this finding.

**Table 6: Effect of different acids on the area yield of lamb skin**

| Acid used | Area, as % of THPS pretan area | | | |
|---|---|---|---|---|
| | wet blue (%) | | crust (%) | |
| | Avg | SD | Avg | SD |
| Formic acid | 106.4 | 1.0 | 96.6 | 3.8 |
| Sulphuric acid | 103.7 | 3.3 | 94.5 | 2.3 |

* Difference not significant ($p > 0.05$)

The physical properties as given in Table 7 showed significantly lower values for grain and tear strength of leather treated with sulphuric acid when compared with that obtained with formic acid. Larger scale trials are required to confirm this.

**Table 7: Physical properties of crust lamb skins**

| | Initial pH | | | |
|---|---|---|---|---|
| | pH 1.25 – 1.5 | | pH 4.0 – 4.5 | |
| | Avg | SD | Avg | SD |
| Thickness, mm | 1.16 | | 1.16 | |
| Grain strength | | | | |
| (a) Load at grain crack, kg | 36.6 | 6.8 | 34.3 | 7.4 |
| (b) Distension at grain crack, mm | 9.7 | 0.5 | 9.9 | 0.6 |
| Tear strength, N/mm | 38.8 | 3.0 | 36.7 | 5.2 |
| Tensile strength, $N/mm^2$ | 17.5 | 4.0 | 17.7 | 4.7 |
| Elongation at break, % | 47.7 | 4.8 | 46.1 | 7.3 |
| Softness, BLC value | 4.7 | 0.5 | 4.7 | 0.6 |

* For each test, values with different letters are significant ($p < 0.05$)

A repeat trial with a dozen skins for each acid treatment indicated a trend for better area yield for formic acid as shown in Table 8 but once again our small scale experimental differences were not statistically significant.

**Table 8: Effect of different acids on the area yield of lamb skin**

| | Area, as % of pickled pelt area | | | | | |
|---|---|---|---|---|---|---|
| | THPS pretan % | | Wet blue % | | Crust % | |
| | Avg | SD | Avg | SD | Avg | SD |
| Formic acid | 103.3 | 3.5 | 104.2 | 4.6 | 97.6 | 5.3 |
| Sulphuric acid | 101.6 | 3.4 | 101.5 | 3.5 | 94.3 | 5.4 |
| No pickle (ThruBlu) | 103.5 | 5.2 | 103.3 | 1.6 | 95.0 | 2.5 |

* Difference not significant ($p > 0.05$)

The chrome content of the exhaust bath was 32 ppm, 84 ppm and 1,500 ppm for the no-pickle, sulphuric and formic acid systems respectively.

### 3.6 Effect pf pH and temperature on the exhaustion of THPS

This is further reflected from the results of residual THPS given in Figure 3, which showed a considerable drop in THPS content at pH 4.5 from pH 2.5 and which remained almost at that level even when the pH was maintained at 6.5 or 8.5.

The exhaustion was considerable higher at 40°C than at 15°C but both followed a similar pattern of exhaustion. The exhaustion of THPS was best at 1% and became poorer with an increased offer; the 2% offer left a considerably higher amount of THPS in the exhaust bath when compared with the 1% offer. It may be inferred that tanning with THPS takes place between pH 4.0–4.5 to 6.0 – 6.5 and about 1% THPS (75% active) might be sufficient for tannage. Incidentally, this is again similar to the findings of Filachione[1].

**Fig 3a: Effect of pH and temperature on the exhaustion of THPS (1% offer)**

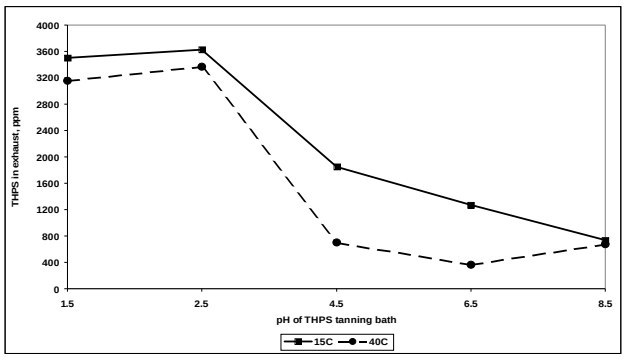



**Fig 3b: Effect of pH and temperature on the exhaustion of THPS (1.5% offer)**

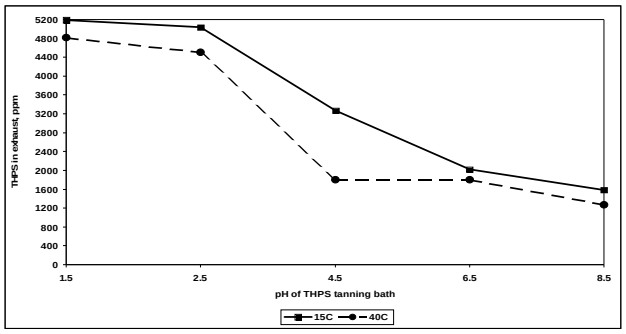
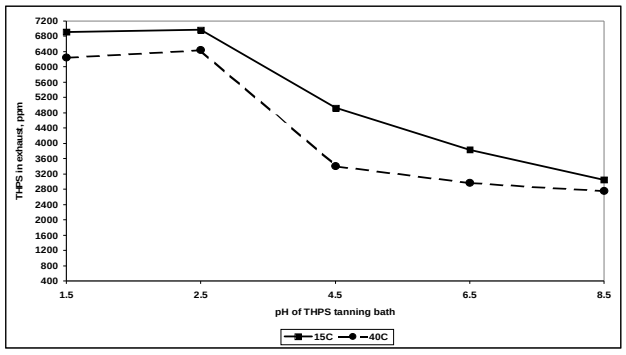


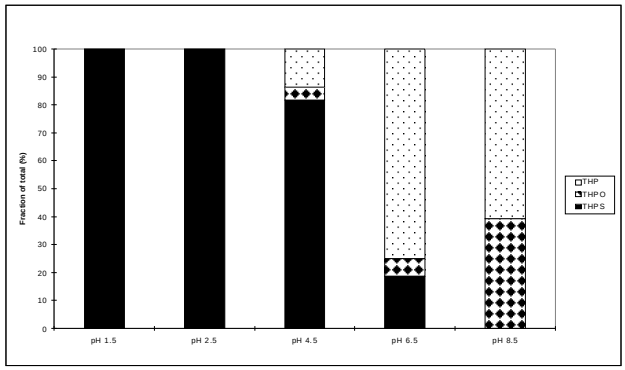

**Fig 3c: Effect of pH and temperature on the exhaustion of THPS (2% offer)**




### 3.7 Exhaust of THPS from bath and Uptake of Phosphorus

The exhaustion of THPS from the bath and the uptake of phosphorus into the skin in the same process as determined by Allsop are shown in Figure 4.

**Figure 4: Rates of phosphorus uptake and THPS exhaustion**




By pH 8.5 no THPS remained and an increasing proportion of THPO was formed.

There was an initial increase in skin phosphorus content within the first 30 minutes together with a decrease in the float concentration of THPS. This was a result of the penetration of THPS into the skin and equilibration with the skin moisture. However, while the pH remained low there was little change in either of these values beyond random fluctuations. When the pH was increased the reaction between the skin and the tanning agent gave a decrease in THPS in solution and a further uptake of phosphorus into the skin. In the initial stages, at low pH a small proportion of THPS was converted to THPO but these levels were essentially static until the pH was increased. With basification the proportion of THPO increased until at high pH (> 6.8) all of the P-containing species were present as THPO. Note that as the pH decreased during overnight processing there was no reversion to reform THPS. THP appeared only at pH 6.11 and as a low proportion of the P species present (11%).

### 4. Chrome tanning and retanning

The degreased skins were repickled with formic acid to bring the pH to 3.2 and then chrome tanned and retanned following a standard method. Samples were taken from neck and butt areas of each of the half skins before degreasing

and after degreasing at the wet blue stage for determination of extractable fat with DCM following the method prescribed in BS:1309:1974. Samples were taken from neck and butt areas of each of the half skins at the wet blue stage for determination of chrome content following the method prescribed in BS:1309:1974. The exhaust chrome tanning liquor was also analysed for residual chrome by Atomic Absorption Spectroscopy.The total phosphorus concentrations of skin pieces and liquors were measured by a colorimetric method, after the samples had been mixed with calcium carbonate, dried and ashed at 500°C for 16 hours. The ash was taken up in dilute nitric acid, the solution was filtered and an aliquot taken for the colorimetric test. Recoveries of phosphorus added as orthophosphate or as THPS to the samples prior to ashing were 97% and 92% respectively. The redox potentials of process liquors were measured with an Endress and Hauser redox electrode. Negative readings indicate reducing conditions. Free Formaldehyde in crust leather Samples of crust leather were extracted and analysed for free formaldehyde by method JIS L1041:1980. Skin samples were cut into pieces and extracted with water at 40°C for 1 hour and the extracts then analysed for formaldehyde while liquor samples were diluted as appropriate for direct colorimetric analysis. Volatile formaldehyde was estimated by incubating solutions in sealed containers with an absorbing solution for 16 hours at 40°C and then measuring the formaldehyde content of the absorbing solution. The dimedone confirmation test was applied to all samples.

**Table 9: Effect of different degreasing on the area yield of lamb skin**

| | Wet blue* | | Crust* | |
|---|---|---|---|---|
| | Avg | SD | Avg | SD |
| Glutaraldehyde (50%) + Polyglycol ether | 109.0 | 8.2 | 108.2 | 7.2 |
| THPS (75%) + Nonylphenol ethoxylate | 106.7 | 8.9 | 104.9 | 8.0 |
| THPS (75%) + Alcohol ethoxylate | 104.9 | 7.4 | 102.0 | 3.3 |

* Difference in values are not significant ($p > 0.05$)

The colour of the crust leathers was measured for Comparison of depth of shade at four points within the official sampling position of all full skins using a Microflash 200d Unit (Data Colour International Ltd). The results of visual grading and colour measurement are given in Tables 10 and11.

**Table 10: Comparative visual assessment of degreasing on full skins**

| Treatments | Visual grade (1 = best, 5 = worst) | | | | | Remarks |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | |
| Glutaraldehyde (50%) + Polyglycol ether | 2 | 3 | 1 | 0 | 0 | very good |
| THPS (75%) + Nonylphenol ethoxylate | 3 | 2 | 1 | 0 | 0 | very good |
| THPS (75%) + Alcohol ethoxylate | 3 | 3 | 0 | 0 | 0 | very good |

**Table 11: Comparative colour values of pretanned crust leather**

| Treatments | Colour difference values, ΔE | | | |
|---|---|---|---|---|
| | Undyed crust | | Dyed crust | |
| | Avg | SD | Avg | SD |
| Glutaraldehyde (50%) + Polyglycol ether | 42.25[a] | 0.74 | 73.44[a] | 0.71 |
| THPS (75%) + Nonylphenol ethoxylate | 40.35[b] | 0.77 | 72.93[a] | 0.72 |
| THPS (75%) + Alcohol ethoxylate | 39.49[b] | 1.44 | 73.01[a] | 0.48 |

*values with different letters are significant ($p < 0.05$)

There were no significant differences between the three groups degreased with polyglycol ether, nonylphenol ethoxylate and alcohol ethoxylate in the grades of degreased leather. The quality of degreasing was in all cases excellent.

The colour of the crust, however, was slightly lighter for the nonylphenol ethoxylate and alcohol ethoxylate than that obtained with glutaraldehyde and polyglycol ether. This difference may be attributed to the effect of glutaraldehyde and not to the effect of the difference between the surfactants. However, these difference was not noticeable on leather dyed with a commercial black dye.

The results of tear strength, tensile strength, elongation at break, grain strength and softness measurements are given in Table 12, 13, 14 and 15. These results represent the means of four measurements on each of three skins.

**Table 12: Comparative tear strength of pretanned crust leather***

| Treatments | Thickness (mm) | | Tear load (N) | | Tear strength (N/mm) | |
|---|---|---|---|---|---|---|
| | Avg | SD | Avg | SD | Avg | SD |
| Glutaraldehyde (50%) + Polyglycol ether | 1.40 | 0.22 | 28.1[a] | 3.3 | 20.2[b] | 1.9 |
| THPS (75%) + Nonylphenol ethoxylate | 1.22 | 0.22 | 31.1[a] | 3.7 | 26.1[a] | 4.6 |
| THPS (75%) + Alcohol ethoxylate | 1.18 | 0.34 | 31.8[a] | 4.2 | 28.9[a] | 7.6 |

*values with different letters are significant ($p < 0.05$)

**Table 13: Comparative tensile strength of pretanned crust leather***

| Treatments | Thickness (mm) | | Tensile load (N) | | Tear strength ($N/mm^2$) | |
|---|---|---|---|---|---|---|
| | Avg | SD | Avg | SD | Avg | SD |
| Glutaraldehyde (50%) + Polyglycol ether | 1.42 | 0.18 | 147.2 | 23.9 | 10.4 | 1.4 |
| THPS (75%) + Nonylphenol ethoxylate | 1.23 | 0.27 | 131.2 | 33.8 | 10.7 | 1.4 |
| THPS (75%) + Alcohol ethoxylate | 1.23 | 0.27 | 138.0 | 34.2 | 11.2 | 1.3 |

* Difference are not significant (p > 0.05)

**Table 14: Comparative elongation at break of pretanned crust leather***

| Treatments | Thickness (mm) | | Elongation at break (%) | |
|---|---|---|---|---|
| | Avg | SD | Avg | SD |
| Glutaraldehyde (50%) + Polyglycol ether | 1.42 | 0.18 | 37.0 | 7.2 |
| THPS (75%) + Nonylphenol ethoxylate | 1.23 | 0.27 | 43.3 | 9.6 |
| THPS (75%) + Alcohol ethoxylate | 1.23 | 0.27 | 39.7 | 6.5 |

* Difference are not significant (p > 0.05)

**Table 15: Comparative grain strength of pretanned crust leather***

| Treatments | Load at grain crack (kg) | | Distension at grain crack (mm) | |
|---|---|---|---|---|
| | Avg | SD | Avg | SD |
| Glutaraldehyde (50%) + Polyglycol ether | 19.4 | 3.1 | 7.9 | 0.2 |
| THPS (75%) + Nonylphenol ethoxylate | 18.5 | 3.9 | 8.2 | 0.2 |
| THPS (75%) + Alcohol ethoxylate | 18.9 | 3.4 | 7.8 | 0.4 |

* Difference are not significant (p > 0.05)

The tear Strength (N/mm) of crust treated with glutaraldehyde (50%) + polyglycol ether appeared to be lower than THPS (75%) + nonylphenol ethoxylate and alcohol ethoxylate treated crust.This may be attributed to the increase in thickness of the leather due to the retannage as the absolute values were not significant. The results of all other physical properties indicated that there were no significant differences between the leathers treated with these three degreasing agents.

**5. Compact Tanning for Chrome free leather :**

Lambskins pretanned and degreased simultaneously with 2% THPS and 4% non-ionic degreasing agent were treated with different amounts of mimosa or tara with and without pretreatment with an auxiliary syntan (Basyntan $RS_3$) for better penetration and distribution. It was found that the shrinkage temperature was adversely affected by the auxiliary syntan, particularly at higher levels of vegetable tanning. The results shown illustrate both this point for mimosa and tara extracts.

**Table 16 : Effect of Auxiliary syntan on the Shrinkage temperature of 2%THPS/Mimosa and 2%THPS/Tara combination tannages**

Shrinkage Temperature, °C

| Application ofveg.Extract | Tara alone | 3%Auxiliary Syntan+ Tara | Mimosa alone | 3%Auxiliary Syn + Mimosa |
|---|---|---|---|---|
| 5.0 | 84 | 72 | 87 | 74 |
| 7.50 | 85 | 73 | 88 | 74 |
| 10.0 | 85 | 73 | 91 | 80 |
| 12.5 | 87 | 73 | 92 | 80 |
| 15.0 | 86 | 72 | 94 | 81 |

This adverse effect was not that significant for mimosa/oxazolidine E combination tannage when similar experiments were conducted with oxazolidine E and mimosa and tara, as seen from Tables 17 and 18

**Table 17 : Effect of Auxiliary syntan on the Shrinkage temperature of 2% Oxazolidine E/ Tara combination tannages**

Shrinkage Temperature, °C

| Application of Tara, % | Tara alone | Tara +1%Ox E | 3% Aux Syn + Tara | 3%Aux Syn + Tara+ 1% Ox E |
|---|---|---|---|---|
| 5.0 | 86 | 87 | 86 | 86.6 |
| 7.50 | 86 | 87 | 86.5 | 88 |
| 10.0 | 86.5 | 88 | 86.5 | 88 |
| 12.5 | 87 | 88 | 86.5 | 88 |
| 15.0 | 86 | 89 | 86 | 89 |

**Table 18 : Effect of Auxiliary syntan on the Shrinkage temperature of 2% Oxazolidine E/ Tara combination tannages**

Shrinkage Temperature, oC

| Application of Mimosa, % | Mimosa alone | Mimosa +1%Ox E | 3% Aux Syn + Mimosa | 3%Aux Syn + Mimosa + 1% Ox E |
|---|---|---|---|---|
| 5.0 | 94 | 98 | 94 | 97 |
| 7.50 | 96 | 100 | 94 | 100 |
| 10.0 | 97 | 100 | 95 | 100 |
| 12.5 | 97 | 100 | 95 | 100 |
| 15.0 | 96 | 100 | 96 | 100 |

These results show that when a high shrinkage temperature is required, mimosa and oxazolidine combination was the preferred material but when assessed visually, it was also observed that tara gave the palest leather.

### 6. Tetrakis hydroxymethyl phosphonium sulphate (THPS) with mimosa condensation products

DasGupta et al (see PCT Int. Application. WO 02,38,813 dated 16 May 2002 ( GB Appl. 2001/ 5,720 dated 8 May 2001) synthesized and patented a compound derived from the condensation of tetrakis hydroxymethyl phosphonium sulphate (THPS) with mimosa and recommended this for tanning of lambskins. The tanning compound was synthesised by reacting 35 to 65 parts of mimosa extract or chestnut extract with 65 to 35 parts of tetrakis hydroxy methyl phosphonium sulphate at 40-50°C for 2 to 6 hours, with constant stirring. These products gave leather with shrinkage temperature of 93-94°C with excellent handle and feel. These novel tanning agents may be used as pretanning agents in the tanning process or in combination with known chrome or aluminium tanning agents. Furthermore, when used in combination with known tanning agents in the tanning process, the hides and skins may be treated with the noveltanning agents prior to or subsequently to treatment with the known tanning agents. It is thought that the novel tanning operates by reacting with hide protein.

In an example of the patents the author used degreased pickled lambskins and adjusted pH to 3.5. Two pelts each were tanned individually in a computer controlled Dose Drum at 12 rpm with varying concentration of the compound for 5 hours, gradually raising the pH of the tanning bath with sodium formate and sodium bicarbonate to pH 5.25 and maintaining the temperature at 35°C. The shrinkage temperature was measured and then further tanned with 9.12% basic aluminium formate (1% $Al_2O_3$) and the final pH of the tanning baths were adjusted to pH 4.4-4.6. The shrinkage temperatures of these pelts were measured. The leathers were fatliquored and crusted out together following a standard process. The results were as given aside:

**Table19: Comparative Shrinkage temperature of leather, oC**

| Compound Applied, % | After tanning with the compound | After final tannage with 1% $Al_2O_3$ |
|---|---|---|
| 5 | 87 | 99 |
| 6 | 87 | 99 |
| 7 | 88 | 99 |
| 8 | 88 | 105 |
| 10 | 90 | 105 |
| 15 | 90 | 102 |
| 20 | 90 | 105 |

The crust leather when assessed for handle and overall quality, was found to give optimum result with 10-15%. At lower applications, the leather looked empty and tiny while at higher level of 20 %, the leather was heavy, fuller and darker.

In another example, pickled lambskins were degreased and pH adjusted to 3.5. These pelts were tanned individually in a computer controlled Dose Drum for 5 hours gradually raising the pH of the tanning bath with sodium formate and sodium bicarbonate to pH 5.20 and maintaining the temperature at 35°C. The shrinkage temperature was measured. These were then separated, allotted at random for further tannages with varying amount of basic aluminium formate (0.5% to 2.5% $Al_2O_3$). One set was adjusted to pH 3.2 with Oxalic acid and other set was processed without lowering the pH to find out the effect of combination tannage with basic aluminium formate at lower pH. The leathers were fatliquored and crusted out. The results were as given in Table 20 :

**Table 20 : Comparative Shrinkage temperature of leather, oC**

| $Al_2O_3$, % | Compound alone | Initial pH=3.2 | Initial pH =5.28 |
|---|---|---|---|
| | 90 | | |
| 0.5 | | 105 | 110 |
| 0.75 | | 106 | 116 |
| 1.0 | | 111 | 116 |
| 1.5 | | 115 | 115 |
| 2.0 | | 101 | 105 |

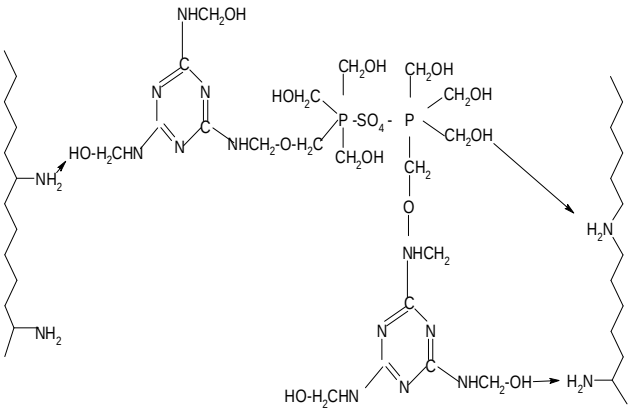
This results showed that 0.5% $Al_2O_3$ is sufficient to give shrinkage temperature above 100°C. Higher percentages did not improve shrinkage temperature any further and it was also not necessary to lower pH before the addition of basic aluminium formate to achieve the highest shrinkage temperature of leather. With increase in

the percentage of aluminium, the colour of the leather became increasingly paler. 1% $Al_2O_3$ gave optimum quality of leather.

### 7. THPS and Melamine formaldehyde resin tannage

D'Aquino, D'Ellia, Naviglio, Seggiani, Tomaselli and Vitolo[30] developed a one-step synthetic tannage based on melamine formaldehyde resin and THPS to obtain shrinkage temperature around 100°C. They proposed that THPS works as a cross-linking agent between melamine resin and collagen and suggested a reaction mechanism as given given in Fig 5.

**Fig 5 : Mechanism of Melamine – formaldehyde resin and THPS with collagen**




### 8. Woolskin Tannage

Very good white woolskins with high shrinkage temperature (85-88oC) might be obtained with Albrite® AD (75% solution of THPS). Tanner's use THPS with or without syntan (15g/l) to obtain satisfactory tanned skins. Well flashed and well scoured wool skin in pickle condition is normally taken for these tannage. The float also varies in normal way based on the length of the wool. Normally, 3-6g/l Albrite® AD (75% solution of THPS) is taken and paddled for 3-4h at lower pickle pH at 10min/h gradual addition of sodium bicarbonate. Finally the bath temperature is raised to 40-45°C and paddled overnight at 10min/h to complete the tannage. The residual formaldehyde and odour may then be removed easily by treatment with small amount of scavenging chemicals like hydrogen peroxide or sodium percarborate. Normally an hour treatment at 40°C with 0.5-1g/l of these chemicals after a hot washing, is sufficient to reduce the formaldehyde level significantly. A white cut section when tested with a selenium indicator should indicate complete oxidation and removal of odour. Formaldehyde level could also be reduced further by repeating the treatment another time or treating the skins with reducing agent (0.5-1g/l) like sodiumdithionite and sodium metabisulphite. The tanning bath may be reused repeatedly by adding about 2-3g/l Albrite® AD (75% solution of THPS) as required each time and adjusting the pH to 4.0.

### 9.0 Formaldehyde content of the crust leather

There is a fear that phosphine might be generated during tannage, so care must always be taken to complete the tannage as recommended by the supplier. THPX might be successfully used to pretan skins and for wet white production. This should be pointed out that a tanner might need higher amount of preservatives, like Busan 30 for long storage. The formaldehyde formed may well be scavenged with various available standard chemicals without problem.

Allsop has done significant amount of work on the scavenging of formaldehyde from hides and skins. Therefore his paper, read at the IULTCS Congress in South Africa is strongly recommended to anyone interested to reduce or eliminate the residual formaldehyde from tanned hides and skins. This is well established that 0.5% hydrogen peroxide (30% solution) worked as an effective scavenger to reduce the formaldehyde level within acceptable limits below 75ppm for THPS alone, but this type of treatment with hydrogen peroxide could not bring down the formaldehyde level for THPS + melamine-formaldehyde resin tanned leather as recommended by Covington and Song Ma. This could be a serious concern for commercialization of the process. Palop (Palop, R, New Options for Chrome-free leather, Leather International, May 2003) showed that by treatment with about 2% Naphthalene sulphonic acid based syntan for 30 min. and then further treatment with 0.5% Sodium perborate for 30min. the residual formaldehyde level in leather might be brought down significantly.

However, use of strong oxidizing agents like perborate, Sodium percarbonate might be problematic if the THMX pretanned hides and skins are further tanned with Basic chrome tanning agents as these might generate hexavalent chromium in such treated the final leather.

Crust lamb skins pretanned with 1.5% THPS and finally chrome tanned and retanned following a standard method had only trace amount of free formaldehyde, well below the acceptable limit, as shown in Table 16.

**Table 21: Free formaldehyde in chrome tanned crust lamb skins**

| | Free formaldehyde (ppm) |
|---|---|
| Pretanned with 1.5% THPS: (on pickle pelt weight) | |
| starting pH 1.15, final pH 6.5 | 3 – 5 |
| starting pH 4.15, final pH 6.5 | 3 – 5 |
| repickled with formic acid | 2 |
| repickled with sulphuric acid | 2 |
| Wet blue lamb skin, retanned for 2h with: (on shaved weight) | |
| 1.0% THPS | 11 |
| 1.5% THPS | 19 |
| 2.0% THPS | 25 |

Therefore the use of hydrogen peroxide is not essential as in the case of woolskin tannage and the risk of damage to the wooden drum may be eliminated.

## 10.0 Conclusion

The following can be concluded from the studies into the tanning characteristics of tetrakishydroxy methyl phosphonium sulphate (THPS):

- Tanning does not take place at a pH lower than pH 2.5, even after 4 hours.
- The optimum pH of tanning is around pH 4.0 – 4.5 to pH 6.0–6.5 where a shrinkage temperature of 80 – 85°C is obtained.
- At pH 6.0 and above, tanning activity is very rapid. The highest shrinkage temperature is reached within an hour.
- The initial pH of the tanning bath has no effect on the final shrinkage temperature of lamb skin, provided the bath pH is raised to around 6.0 – 6.5. A shrinkage temperature of 80 – 85°C is reached. However this might adversely affect the area yield of leather.
- The temperature of tanning is not very important as even at a lower temperature, the optimum shrinkage temperature is obtained within 1 – 2 hours at pH around 4.
- Sulphuric acid if used for repickling should be used with caution as this might have an adverse effect on the grain and tear strength of lamb skins. Formic acid should be the preferred acid. Chrome tanning may be conducted without bringing down the pH by applying ThruBlu technique, without any adverse affect on the quality of leather.
- The starting pH of around pH 4.0 is recommended as this gives an optimum shrinkage temperature within a short period of 2 hours without any adverse affect on the area yield of the leather. When a lower pH below 4.0 is used, the colour of the float turns pink at first around pH 3.0 and then turns yellowish around pH 4.0, suggesting some transformation of THPS.
- THPS is a very reactive tanning agent. Small amounts, around 1 percent (75%) is sufficient for an optimum tannage. It was found that when higher percentages of 1.5 or 2% were used, disproportionately high amounts of THPS remained in the residual exhaust liquor.
- Pretanning with THPS gives satisfactory degreasing similar to glutaraldehyde and has no adverse affect on the tear strength of the leather.
- Chrome tanned lambskin, pretanned or retanned with 1.5% THPS released only trace amounts of free formaldehyde, this amount being well below the acceptable limit.

## Debansu Dasgupta

[17th July 1928 – 22nd January 2017]

Debansu Dasgupta was born on 17th July 1928 in Goilagram in Barisal, India (now in Bangladesh). He was the youngest of three sisters and four brothers. Around the time of independence the family moved to Kolkata. His schooling was in Barisal and he did his graduation in science from St Xavier's College Kolkata. His then joined the Bengal Tanning Institute (now College of Leather Technology) for a postgraduate diploma in Leather Technology. On the advice of Prof B.M Das, the founder director of now famous Central Leather Research Institute, Madras, Tamil Nadu, He went to Leeds for further study and experience in this field. After gaining experience in tanneries around Leeds, he returned to join Kanpur Tannery, Kanpur, U.P. Here he worked for a couple of years when he met and married Late Manjula Dasgupta, from Lucknow.

After marriage, he returned to England and joined Ballybay Tannery, Ireland, where he gradually built up his reputation as one of the finest side leather tanners in Europe. It was during his long stay in Europe while working for leather manufacturing firms in England and Ireland, he come in contact with noted personalities of his profession like Dr Henry Phillips, Director, the British Leather Manufacturers Association (1952-54), late Mr R. Denyer of Yorkshire Chemicals Leeds, late Mr W.D Earnshaw of Earnshaw Finishes Northallerton, England, late E. Crack, Chairman of C.F. Stead, Leeds, who was known to be one of the most outstanding chrome tanners in his time, late Mr G Dickenson, M.D. of Ballybay Tanners Ltd, Ballybay, Ireland. He was a member of the society of Leather Technologist and Chemists, UK, since 1954.

He had two sons Robin and Ronnie. In the year 1972, he decided to return to India to join a newly built tannery in Agra, U.P and soon converted into one of the most successful export oriented tanneries in North India. Later he formed a company called Tower Tanning Company and took charge of Dayalbagh Tannery in Agra.

In the early eighties he moved to Kolkata and worked as a consultant in various tanneries. He never retired and even in his eighties would go to work (as consultant) once a week. He liked to help tanners improve the quality of leather and solve various problems in the leather. In 1997 he participated in the centenary Congress of IULTC at the Elizabeth Centre, London as a delegate from SLTC, UK and considered himself honoured to meet late Prof. Dr E. Heidermann of Germany who provided some vital conclusions on Chrome tanning at the "Heidermann lecture" in the congress in continuation of late Prof Gustavson's valuable scientific study on chrome tanning.

On a personal note, he was a compassionate, loving and caring person.

## LEATHER SECTOR UPS TURNOVER TARGET, 1 LAKH ADDITIONAL JOBS ON CARDS

The Rs 13,000-crore leather industry in West Bengal is looking to push its revenue up by Rs 2,000 crore more in the next two years. The ambitious target, set after the state's industries and finance minister Amit Mitra assured all help to the sector, will generate at least1 lakh additional jobs.

"The leather industry in the state provides employment to 3 lakh people. They have set a target of providing jobs to 1 lakh more people in next two years.But I would urge them to double their target. They will get all support from the government," said Mitra. He was present at the inauguration of India International Leather Fair and TexStyles India 2017. "I would urge them to push their turnover to Rs 15,000 crore and exports to Rs 10,000 crore," he said.

The leather industry in the state, mainly concentrated in the Bantala region, had a turnover of Rs 13,000 crore in 2015-16."Creation of 1 lakh jobs would require an additional turnover of Rs 2,000 crore. This is achievable as many units are ready to start operations. Forty units are waiting for environmental clea rance," said Ramesh Juneja, regional chairman (east) of the Council for Leather Exports.

Spread over 1,100 acres, Bantala Leather Complex houses more than 25 leather units and 375 tanners. "Last year, we declared Bantala as a township.An act has also been passed to that effect. After that, development works picked up pace here," said Mitra. The state has earmarked an investment of Rs 50 crore to create infrastructure facilities at Bantala.

The tanneries here have been facing trouble with the effluent treatment plants for long. While a 20mn liter effluent treatment plant was in operation, two new common effluent treatment plants -each with a capacity of 5mn liter -are being set up.

## BANTALA TOWNSHIP BILL PASSED

The Bengal Assembly has passed a bill to declare Bantala a township in an attempt to clean up the pollution caused by tanneries in the area and to attract investments.

Amit Mitra, finance, commerce and industries minister, said the government had received many complaints about excessive pollution in Bantala. "The Assembly has passed a bill to bring Bantala under the township act so that the government can directly work for the development and improvement of the entire area," he said.

Mitra was speaking at the inauguration of the 22nd India International Leather Fair (IILF) 2017 at the Milan Mela complex today. It was earlier known as the International Leather Goods Fair.

The state's leather industry, which provides employment to 300,000 people, is pegged at Rs 13,000 crore, of which goods worth Rs 7,000 crore are exported.

The government has already taken various steps to develop the Calcutta Leather Complex in Bantala, Mitra said. "We have built a Technical Training and Service Centre at an investment of Rs 14 crore. It is ready for operations. In fact, we have installed Italian machinery worth $2 million there."

The government has pumped in Rs 3 crore for intensive plantation over 50 hectares, he said. Also, major and arterial roads are being repaired.

"We have given 50 acres for a landfill site... a tannery solid waste co-digestion-cum-bio gas generation unit is being piloted by the Central Leather Research Institute. A new industrial cooperative representing 300 micro leather units has been formed for settlement in the complex as micro, small and medium enterprises cluster."

The minister said the underground water availability for extraction had been assessed at 35 million litres a day. The Indian Leather Products Association has taken the initiative to set up a common sewerage treatment plant for leather goods manufacturing units, he said.

The leather complex is spread across 1,100 acres; 970 acres are available for leather activity, of which 202 acres have been dedicated to tanneries. As of now, 325 wet tanneries and 39 leather units operate out of this zone.

The complex has four common effluent treatment plants (CETPs) with a total capacity of 20 million litres a day. It has seven pumping stations, a common chrome recovery plant, illuminated internal roads, a footwear design and development institute, four power substations and a facility to provide drinking water.

Mitra said the government had proposed to create and develop more infrastructure under the mega leather cluster of Indian Leather Development Programme. "We want to add two new CETPs, each with a capacity of five million litres a day, while renovating the existing ones. Overhauling and extending the effluent transport system and cleaning and refurbishing internal canals is on the cards."

A sanitary landfill site for hazardous waste and a footwear park on a public-private-partnership model on 100 acres is on the agenda as well.

Common facility centres for the leather goods sector as well as for providing services and facilities to micro tanneries have been proposed. "We will complete all these projects within the next three years," Mitra told Metro on the sidelines of the event

*(Source: The Telegraph, 27.02.2017)*

**MORE FUNDS ON EXPORT WISH LIST**

Labour-intensive exporters hit hard by the note ban are in line for sops. The government may allocate additional sum under export incentive schemes to sectors such as textiles, engineering products and leather, affected by demonetization.

"We have asked the finance ministry to allocate additional sum to boost exports from labour-intensive sector through MEIS (Merchandise Exports from India Scheme) and continuation of interest subsidy. We have to wait and watch what the finance ministry does," a senior commerce ministry official said.

The MEIS scheme, applicable for the export of specific products and identified markets, are eligible for direct sops in the form of duty-free scrips. The scheme started in April, 2015 with an annual budget of Rs.18,000 crore, which was increased in phases to Rs.23,000 crore. The scheme now covers 7,103 items against 5,012, initially.

Sources said the finance ministry was likely to continue the 3 per cent interest subsidy scheme in the forthcoming budget to help exporters tide themselves over the tough global trade environment.

"The scheme was announced in November 2015 and we expect it to continue in this budget also," sources said.

The scheme, called the interest equalization scheme on pre and post shipment rupee export credit, is available to all micro, small and medium enterprises and 416 tariff lines. Continuation of the scheme would help sectors such as handicrafts, carpets, tea and rice.

"We are expecting Rs.2,500 crore in this budget from the finance ministry. It is important because the cost of credit is still very high in India compared to global benchmarks. We would urge the Centre to continue with this scheme," Ajay Sahai, Director General of the Federation of Indian Export Organizations, said.

*(Source : The Telegraph, 12.01.2017)*

## BATA TO CHOOSE FRANCHISE MODEL FOR STORE EXPANSION

Bata India is eyeing Tier-III and Tier-IV cities through a franchise model rather than opening new stores, according to Rajeev Gopalakrishnan, President – South Asia, Bata Emerging Markets.

"Considering the fact that retail business will grow rapidly in Tier-III and Tier-IV markets over the next five years, due to increasing disposable incomes and the fact that these markets are largely unrepresented by organized players, it was decided to enter new markets through franchising instead of opening own stores," he said.

*(Source : Indian News Agency, 09.01.2017)*

## RIGHT TIME TO OUTSHINE CHINA IN SHOES & CLOTHES

India is witnessing a "historic opportunity" to take over China in the apparel, leather and footwear sectors but it is being outrun by its neighbouring East Asian economics, the Economic Survey has said.

The Survey said in spite of significantly lower wages than China, countries such as Bangladesh, Vietnam and Myanmar have outpaced India in these sectors.

"The window of opportunity is narrowing and India needs to act fast if it to regain competitiveness and market share in these sectors," the Survey said. The monthly wages for semi-skilled workers in India ranges between $81 and $119, while in China its $250-300. India's wages costs are even less compared with Vietnam and Indonesia but challenges of logistics, labour regulations, tax and tariffs policy have put India at a disadvantages in a global scenario.

These difficulties have led to several Indian firms choosing to relocate to Bangladesh, Vietnam, Myanmer and Ethiopia. All of these factors have brought India's share in global exports of apparel, footwear and leather to less than 5%, falling behind countries such as Bangladesh and Vietnam.

*(Source : Economic Times – 01.02.2017)*

## STRAPS DO NOT A SANDAL MAKE, RULES DELHI HIGH COURT

Is a woman's footwear without a back strap a "sandal" or a "chappal" ? The Delhi High Court has ruled that it is a "sandal."

The judgement came after a Chennai-based footwear manufacturer, Wishall International, challenged the Centre's position that a woman's footwear without a back strap is a chappal and not a sandal.

At the core of the dispute is the Centre's customs duty drawback of 10% on export of sandals while export of chappals attracts only 5%. A customs duty drawback is a refund given to business houses or manufacturers who import machinery or raw material to produce goods for export. These manufacturers pay import duty on purchase of the raw material but can later claim a drawback, or refund on the duty paid, as they export their product. This is done to encourage exports.
The dispute arose in May 2003 when the company filed a shipping bill to export "ladies leather sandals." The Customs Department in New Delhi said the export consignment contained chappals not sandals.

Wishall demanded a duty drawback at 10%, claiming their products were sandals but the Centre and Revenue Department claimed they were chappals and hence the company was entitled to only 5%.

**Tit-for-Tat**

The company then sought the opinion of the Council of Leather Exports, which cleared the consignment as sandals. The Customs in turn moved to the Council, which now sought the opinion of the Footwear Design and Development Institute (FDDI) in Noida. The FDDI ruled the products to be chappals.

The Customs then served a showcause notice on the company, demanding recovery of the drawback already paid at 10% as well as penalty.

The dispute ultimately landed before the Delhi High Court, where the company said the fact that the product did not contain a back strap did not "detract from the fact that they were known to the users as sandals."

A Bench of Justice S. Ravindra Bhat and Justice Najmi Waziri ruled that the Centre and the Revenue Department "acted upon prejudice and a preconceived notion that ladies sandals cannot be without a back strap."

"The Council, a Central Government body, which routinely deals with these issues, had furnished an opinion that the goods were sandals and not chappals. Apart from this, the court wonders whether any of the experts in this case was a woman, the ultimate customers," the Bench said.

*(Source : Hindu – 28.01.2017)*

## AMERICAN WITHDRAWAL FROM TPP WILL BOOST INDIAN LEATHER EXPORTS

The United States formally withdrawing from the Trans-Pacific Partnership would benefit the domestic leather industry, a top official of industry body Council for Leather Exports said here, on Tuesday.

"Already the leather exports to US market has been increasing with an year-on-year increase of about 8 per cent as of 2014-15. With the new President Donald Trump withdrawing US from TPP it will benefit our industry in future", Council for Leather Exports, Vice Chairman, P R Aqeel Ahmed told reporters.

Soon after becoming the New President of United States, Donald Trump last week formally withdrew his country out of the Trans-Pacific Partnership by signing an executive action from the negotiating process of the 12-nation trade deal, one of the major international trade initiatives of his predecessor Barack Obama. Responding to a query on how it would benefit the Indian market, Ahmed said compared to the exports made from other Asian markets to US, India holds advantage of witnessing a rise in leather exports as products were well received there.

Giving some statistics on exports, Ahmed said between April-November 2016 period India's leather exports was about $605 million of which 15.89 per cent was contributed from United States. "Exports to United States grew in 2015-16 but it declined from Europe", he said.

On the overall domestic exports, he said the shipping of finished leather and leather products which witnessed about 10 per cent decline in 2014-15 has come down 3-4 per cent decline in 2015-16. Ahmed and senior officials of Council for Leather Exports were here to announce the second edition of the Designers Fair which began on Tuesday.

*(Source : Millenium Post – 01.02.2017)*

**IILF PROJECTS INDIA AS AN INVESTMENT LAND**

Unveiling the export potential of Indian Leather industry, the 32nd edition on India International Leather Fair was inaugurated by the Minister of Environment and Pollution Control, Thiru K. C. Karuppannan at Chennai Trade Centre, Chennai. The function was presided over by Shubhra Singh, IAS, Executive Director, India Trade Promotion Organization (ITPO).

Present on the occasion were Mukhtarul Amin, Chairman, Council for Leather Exports, Jayanta Das, General Manager, ITPO, P. R. Aqeel Ahmed, Vice Chairman, CLE, S. Visakan, MD, TNTPO, senior representatives of apex leather bodies, participants and delegates from India and abroad.

*(Source : Pioneer – 04.02.2017)*

## Glimpse of 34th IULTCS Congress 2017

Indian Leather Technologists' Association (ILTA), the member society of IULTCS and its' only representative from India was entrusted for organizing the 25th IULTCS Congress in India in 1999 for the first time, which enlightened the leather world with a grand success at CLRI campus under the stewardship of legendary personality Mr. Sanjoy Sen, the then ILTA President and Dr. T. Ramasami, the then Director, CLRI. The global success of that event was felt as a benchmark for any event of this kind at that time.

For the second time the baton of conducting 34th IULTCS Congress was handed over to India through ILTA who joined hands with CLRI and decided to hold the congress in Chennai during February 5th – 8th, 2017. The theme of the congress was appropriately chosen as **"Science and Technology for Sustainability of Leather"**. Due to change of time and the desire to set a new benchmark, it was decided to select the venue at ITC Grand Chola, Chennai to give the right ambience to the proceedings.

Dr. T. Ramasami was gracious enough to agree to be the President of the event and an organizing committee was formed with representations from Indian Leather Technologists' Association (ILTA), CSIR – CLRI and the Leather Industry fraternity. Council for Leather Exports (CLE), and Indian Finished Leather Manufacturers Association (IFLMEA) had agreed to be the Industry partners to the event. The event got generous support from various section of the leather sector including Chemical companies through sponsorship and other supporting systems. The organizing committee through Secretariat was in constant touch with the President Dr. Tegtmeyer and Secretary Dr. Campbell Page of IULTCS Congress for making plans in tune with their expectations.

The Inaugural session of the Congress was held on 6th February, 2017 with the ceremonial parade with playing of IULTCS anthem. Dr. B. Chandrasekaran, Director, CLRI, delivered the Welcome Address to the gathering from around the Globe and the recorded messages from dignitaries like Shri Rafeeque Ahmed (Chief Patron of the Congress), Shri Mukhtharul Amin (Chairman of CLE) and the other dignitaries, Shri Aqueel Ahmed, Mr. Shafeeque Ahmed, Mr. Israr Ahmed were played on during the session. Mr. Tegtmeyer, Dr. Campbell Page, and his Excellency Bohale Feleke, Minister of State for Industries, Government of Ethiopia delivered their speeches on the occasion. Mr. Arnab Jha, President, ILTA proposed the Vote of Thanks and the event concluded with the national anthem.

The Hiedemann Lecture for 2017 was delivered by John A M Ramshaw, Australia on the topic Probing Collagen Structure and function, which was the right tribute to the contribution of Professor Hiedemann.

The IULTCS Merit Award was given to Dr. Marilitz Gutteres from Brazil and the award was presented on 7th February by the President, IULTCS Dr. Tegtmeyer.

There were eight technical sessions with different topics, Fundamentals in Leather Science, Advances in Chemicals for Smart and Intelligent Leather, Innovation and Value Addition for Leather (First Day), Strategies for Sustainability of Leather, Emission Control Strategies (Second Day), Design and Innovation for Lifestyle Leather Products, Enriching Human Capacities / Global Research Alliances and Partnerships. There were totally 6 keynote speakers and 43 oral presentations and more than 200 poster presentations, which were selected duly by an international jury comprising of eminent scientists and technologists. The quality of papers was befitting the overall theme as well as the stature of the congress.

230 registered international delegates from 28 countries and totally 650 delegates from nation and abroad attended the congress. Participants included 350 students from 6 countries. Ten students from Govt. College of Leather Technology, Kolkata attended the congress by sponsorship from TFL.

Sri Arnab Jha, President ILTA, Sri Susanta Mullick, General Secretary, ILTA and Dr. Goutam Mukherjee, Hony Editor, JILTA, joined hands with CSIR – CLRI while organizing the mega event being at Chennai. Sri Aniruddha De EC member, ILTA and Sri Bibhas Chandra Paul, OSD, ILTA also stayed back at Chennai during those days for rendering necessary logistic supports on behalf of ILTA central office, Kolkata.

Apart from the technical sessions there were Executive Committee and various Subcommittee Meetings. President, ILTA and Hony. Editor, JILTA attended those subcommittee meetings.

The foreign delegates were demonstrated with Indian Cultural and Art Forms through a visit to Kalashetram on 6th evening and a Popular Lecture on fusion of science and music by Dr. T. Ramasami and Umayalpuram K Sivaraman was delivered on 7th evening.

From the feedback, received from the congress delegates it was evident that the 34th IULTCS Congress has been a memorable one and everybody feels this has set a new benchmark for the subsequent congresses to emulate.

Dr. N. K. Chandrababu, Covenor of the Congress offered the Vote of Thanks to the delegates by expressing his heartfelt gratitude to the Chief Patron and President of the Congress, President and Secretary of IULTCS and various Industries, Associations, Institutions partnering the event. He also offered thanks to various sponsoring agencies and companies, without the generous support from which the event could not reach to the highest level of excellence. He also congratulated to the Congress Organizing Committee for all the hard work they had put in to make the event such a memorable one. He also thanked the media partners for their continued coverage and support to the congress. Lastly he mentioned with thanks and gratitude the name of Indian Leather Technologists' Association and its' pioneers who had taken a major role to make India to be a part of IULTCS and helped the Indian Leather Fraternity as a whole.

The 3 days mega event then concluded with National Anthem.

**OSD, ILTA**

# Revisiting India's Economic Reforms after 25 years

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**ABSTRACT :**

Economic reforms refers to the introduction of innovative policies such as eliminating the market barriers, and encouraging economic participation from private sector, reducing the fiscal deficit, increasing export and reducing imports etc for increasing the growth rate of the economy. Indian economic reforms had undergone many changes since 24th July,1991. 'No power on earth can stop an idea where time has come' said the prime minister Manmohan singh quoting Victor Hugo while presenting the union budget that started the long process of economic liberalization in India. The liberalization aimed at ending the license permit raj by decreasing government intervention in the business thereby pushing economic growth through reforms. The policy opened up the country to global economy. It discouraged public sector monopoly and paved the way for competition in the market. The policy was met with wide opposition from within and even the domestic industry, was seen as the only way for India after the balance of payment crisis, as it became the victim of twin-deficits.

The reform package introduced in 1991 was under the guidelines of IMF known as structural Adjustment program. This comprised of two components namely Macro- economic stabilization and structural reform. Price stability is the concern for stabilization package. This can be achieved through a set of financial adjustments followed by price corrective measures. Overall the economic reforms integrated domestic economy in terms of business industry/trade and at the same time created space for the young entrepreneurs. This was more pro market and pro business orientation accompanied by exchange of new ideas within the new dynamic environment.

India opened up slowly in a gradual manner, specially due to the effect of MNC's role in globalization. The extent of globalization in the context of economic reform led to Industrial restructure. The entry of foreign capital was facilitated by operation of MNC's through setting up of subsidiary or getting into foreign collaboration . As Indian economy strived this leap it transformed from a monopolistic economy to a highly competitive economy. Measure towards globalization was taken as Investment reform in form of FERA and FEMA. It was evident that inflow of foreign capital will enhance economic growth. However the question was whether it would lead to Substantive economic growth. The answer was India's Inclusive nature made a series of crisis specially in the area of employment. The era of 2000 was termed as jobless growth. The growth of casual and contractual labour raised question job satisfaction and mainly on job security. The planning of Inclusive growth led to decentralization, for instance success was seen in service sector mainly felt by IT professionals and also the sudden growing spurge of the white collars. Gradually the Indian economy shifted from labour intensive production to highly specialized capital Intensive Industrial structure.

Through these years of innumerable progress and reform India has reached a certain position as Asia's third largest and world's fastest growing economy.

**KEYWORDS**

**Liberalisation -** Liberalisation means to unshackle the economy from bureaucratic cobweb to make it more competitive.

**Fiscal Deficit** - A **fiscal deficit** occurs when a government's total expenditures exceed the revenue that it generates, excluding money from borrowings. **Deficit** differs from debt, which is an accumulation of yearly **deficits**.

**Balance of payments** - The **balance of payments**, also known as **balance** of international **payments** and abbreviated BoP, of a country is the record of all economic

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transactions between the residents of the country and the rest of the world in a particular period (over a quarter of a year or more commonly over a year)

**Macroeconomic stabilization** - It is a condition in which a complex framework for monetary and fiscal institutions and policies is established to reduce volatility and encourage welfare-enhancing growth.

**Structural Reforms** - They are **reforms** made to address long term aspects of the economy, as opposed to short term, recession fighting (counter-cyclical) measures. **Structural reforms** could include changes in the legal system, taxes, property rights, etc.

**MNCs** - A multinational corporation(**MNC**)is usually a large corporation incorporated in one country which produces or sells goods or services in various countries.The two main characteristics of **MNCs** are their large size and the fact that their worldwide activities are centrally controlled by the parent companies.

**Monopolistic economy** - The exclusive possession or control of the supply of or trade in a commodity or service.

**FERA** - The **Foreign Exchange Regulation Act** (**FERA**) was legislation passed in India in 1973 that imposed strict regulations on certain kinds of payments, the dealings in foreign exchange (forex)and securities and the transactions which had an indirect impact on the foreign exchange and the import and export of currency.

**FEMA** - The **Foreign Exchange Management Act, 1999** (FEMA) is an Act of the Parliament of India "to consolidate and amend the law relating to foreign exchange with the objective of facilitating external trade and payments and for promoting the orderly development and maintenance of foreign exchange market in India"

**Globalization** - The process by which businesses or other organizations develop international influence or start operating on an international scale.

**Inclusive Reform** - Economic growth that creates employment opportunities and helps in reducing poverty. It means having access to essential services in health and education by the poor. It includes providing equality of opportunity, empowering people through education and skill development.

**Capital-Intensive** - Business or Industrial process requiring the investment of large sums of money.

**INTRODUCTION :**

The process of economic reforms was started by the government of India in 1991 for taking the country out of economic difficulty and speeding up the development of the country. The need for a policy shift had become evident much earlier, as many countries in East Asia achieved high growth and poverty reduction through policies which emphasized greater export orientation and encouragement of the private sector. India took some steps in this direction in the 1980s, but it was not until 1991 that the government signaled a systemic shift to a more open economy. Fiscal profligacy was seen to have caused the balance of payments crisis in 1991 and a reduction in the fiscal deficit was therefore an urgent priority at the start of the reforms.

The centre of economic reforms has been liberalization, privatization and globalization. Reforms in industrial and trade policy were a central focus of much of India's reform effort in the early stages. Industrial policy prior to the reforms was characterized by multiple controls over private investment which limited the areas in which private investors were allowed to operate, and often also determined the scale of operations, the location of new investment, and even the technology to be used. The industrial structure that evolved under this regime was highly inefficient and needed to be supported by a highly protective trade policy, often providing tailor-made protection to each sector of industry.

Industrial policy has seen the greatest change, with most central government industrial controls being dismantled. The list of industries reserved solely for the public sector— which used to cover 18 industries, including iron and steel, heavy plant and machinery, telecommunications and telecom equipment, minerals, oil, mining, air transport

services and electricity generation and distribution — has been drastically reduced to three: defense aircrafts and warships, atomic energy generation, and railway transport. Industrial licensing by the central government has been almost abolished except for a few hazardous and environmentally sensitive industries. The requirement that investments by large industrial houses needed a separate clearance under the Monopolies and Restrictive Trade Practices Act to discourage the concentration of economic power was abolished and the act itself is to be replaced by a new competition law which will attempt to regulate anticompetitive behavior in other ways. Trade policy reform has also made progress, though the pace has been slower than in industrial liberalization. Before the reforms, trade policy was characterized by high tariffs and pervasive import restrictions. Imports of manufactured consumer goods were completely banned. For capital goods, raw materials and intermediates, certain lists of goods were freely importable, but for most items where domestic substitutes were being produced, imports were only possible with import licenses. The criteria for issue of licenses were nontransparent, delays were endemic and corruption unavoidable. The economic reforms sought to phase out import licensing and also to reduce import duties. Liberalizing foreign direct investment was another important part of India's reforms, driven by the belief that this would increase the total volume of investment in the economy, improve production technology, and increase access to world markets. The policy now allows 100 percent foreign ownership in a large number of industries and majority ownership in all except banks, insurance companies, telecommunications and airlines. Procedures for obtaining permission were greatly simplified by listing industries that are eligible for automatic approval up to specified levels of foreign equity (100 percent, 74 percent and 51 percent). Potential foreign investors investing within these limits only need to register with the Reserve Bank of India. For investments in other industries, or for a higher share of equity than is automatically permitted in listed industries, applications are considered by a Foreign Investment Promotion Board that has established a track record of speedy decisions. In 1993, foreign institutional investors were allowed to purchase shares of listed Indian companies in the stock market, opening a window for portfolio investment in existing companies.

These reforms have created a very different competitive environment for India's industry than existed in 1991, which has led to significant changes. Indian companies have upgraded their technology and expanded to more efficient scales of production. They have also restructured through mergers and acquisitions and refocused their activities to concentrate on areas of competence. New dynamic firms have displaced older and less dynamic ones: of the top 100 companies ranked by market capitalization in 1991, about half are no longer in this group. Foreign investment inflows increased from virtually nothing in 1991 to about 0.5 percent of GDP. Although this figure remains much below the levels of foreign direct investment in many emerging market countries (not to mention 4 percent of GDP in China), the change from the pre-reform situation is impressive. The presence of foreign-owned firms and their products in the domestic market is evident and has added greatly to the pressure to improve quality.

One reason why export performance has been modest is the slow progress in lowering import duties that make India a high cost producer and therefore less attractive as a base for export production. Exporters have long been able to import inputs needed for exports at zero duty, but the complex procedure for obtaining the necessary duty-free import licenses typically involves high transactions cost and delays. High levels of protection compared with other countries also explains why foreign direct investment in India has been much more oriented to the protected domestic market, rather than using India as a base for exports. However, high tariffs are only part of the explanation for poor export performance. The reservation of many potentially exportable items for production in the small scale sector (which has only recently been relaxed) was also a relevant factor.

**Discussion**

While many would argue that the process of economic reforms and opening up of the economy had started earlier, in the 1980s, the fact remains that the events that unfolded after 1991 did result

in a clear shift in the ideology behind Indian economic policy, from a dirigisme regime to a market-friendly regime. It is then appropriate to evaluate the successes and failures of the past 25 years, a period which has seen unprecedented growth as well as poverty reduction. While there is a consensus that the economy has done better after 1991 than in the earlier period according to standard metrics of economic performance, there are concerns about the performance of the economy on various social indicators. These appear to be worse, given the high growth rate that the economy has achieved in the past decade.

But the real issues are not just the successes and failures of reforms but also the sustainability of the growth path that the economy has followed since 1991. The recent slowdown in economic growth may just be temporary but there are serious concerns that raise questions about the sustainability of the reforms as well as the future of economic reforms. First among these is the issue of inequality, which by all measures has continued to rise since 1991. The rise in economic inequality has been consistent and has been seen on measures of consumption expenditure as well as on incomes. Some of the inequality may not be harmful if it is seen as just reward for skills or entrepreneurship.

Unfortunately, on both these counts concerns remain. While wages of highly skilled employees have shown a secular upward trend, a large majority of workers, particularly in the unorganized sector, haven't seen wages rise commensurately in real terms. Along with a trend towards casualization and contractualization, there has been a worsening of employment quality and lack of social security even for those employed in the organized sector. But a far more serious issue is the rise of crony capitalism. If the purpose of economic reforms was to get rid of the license-permit raj, the reforms have failed to create a level playing field with crony capitalism, not just obvious in the case of natural resources such as petroleum, coal, iron and spectrum, but also among industries which have seen the opening up of markets and deregulation. The fact that the banking and finance sector, which was among the first to be opened up, is struggling with non-performing assets is a clear reminder of the perils of unregulated liberalization and crony capitalism.

While economic inequality has certainly been a hindrance for the majority of the poor to benefit from the fruits of economic reforms, the failure of the government to deal with structural inequality has also created a class of marginalized and vulnerable people. These structural inequalities embedded in class, caste, gender and religion have not only grown after reforms, attempts at privatizing public services such as health and education have also led to further marginalization of the disadvantaged groups from the mainstream. The low improvement in social indicators has also been accompanied by growing distance between the Scheduled Castes/Scheduled Tribes/minorities versus the rest. The net result of the accentuation of the trend of rising inequality has been social unrest across social categories and across states.

However, the biggest challenge for the economy ever since the economic reforms were initiated has been the lack of employment creation. The fact that the workforce structure hasn't seen much change from 1991 is a clear reflection of the lopsided nature of economic growth. The agricultural sector continues to remain the largest employer with the absolute number of workers declining only recently. But the non-farm sector, which has been the engine of growth, has failed to absorb either those displaced by the agricultural sector or the new entrants to the labour force. These new entrants to the labour force are not just better educated and skilled than their counterparts in agriculture, but also more aspirational.

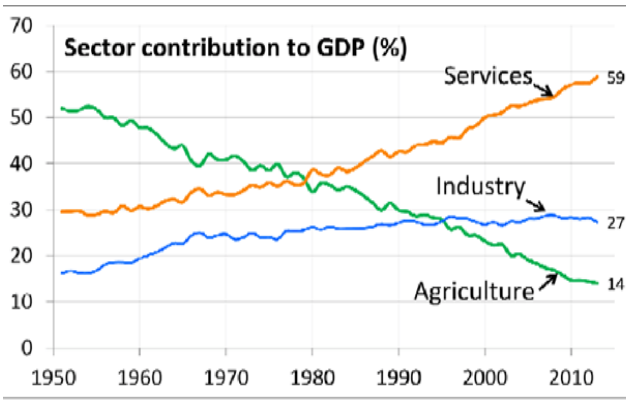
The lack of employment opportunities for a large majority is now reflected in social unrest such as the clamour for reservation by certain groups such as the Patidars, Marathas and the Jats. The deterioration of employment quality has also created a class of workers who are employed but remain vulnerable. Twenty-five years since the reforms were initiated, it is not just an opportunity to evaluate what has happened in the past 25 years but also reassess the challenges of economic growth and poverty reduction in the next 25 years.

The decades prior to 1991 may have been years of slow growth, but it is equally true that state-led

growth did create capacities which enabled the economic reforms to reap the benefits of liberalization. At a time when the economy is still vulnerable to rainfall variation despite decades of agricultural growth, the issue of economic revival is not just about opening up the economy and liberalizing the trade environment. The fundamental issues of inequality, lack of social progress and inability of the economy to generate jobs require a strategic response if the process of reforms and growth has to continue. It is time for the next generation of reforms—those that deal with the structural bottlenecks to growth—rather than more of the same.

**Analysis**

We have seen landmark shift in Indian Economy since the adoption of new economic policy in 1991. This had far reaching impacts on all spheres of life in India. There can be no concrete conclusions about their impact on Indian people. This turns out to be more of an ideological debate like capitalism vs Socialism. But there is no doubt in the fact that those reforms were unavoidable and very compelling. There was in fact, similar wave all across the globe after disintegration of USSR and end of the Cold War. Many Post-colonial democratic regimes, which were earlier sheltered by USSR, lost their umbrella. They had no option, but to fall in line to new unipolar world order dictated by USA. Even China in late 1980's adopted 'Open Door Policy' through which it liberalized its economy by shedding communist mentality completely. South East Asian economies also reformed their economy and started engaging more with global economy. These along with China, pursued export led growth whereas Indian economy still relies almost wholly on domestic consumption.




Patterns in the above graph explain inequity of Indian growth story. As per principle of economics, when a particular sector performs disproportionately higher than average growth rate, economic wealth starts concentrating into that sector. In this case that sector is Service sector. Within this sector, highest growth is marked by sectors such as financial services, Real estate services etc., which are least employment elastic. Consequently, Growth of past decade was limited to upscale areas of the countries as almost whole service industry, operates from these areas. Majority of India got spillover or trickle down growth from here. This accelerated migration to urban areas. This in turned created array of social problems associated with urbanization. It fundamentally changed pattern of Indian Society.

**GDP growth rate –** India's annual average growth rate from 1990 – 2010 has been 6.6 % which is almost double than pre reforms era. GDP growth rate surpassed 5% mark in early 1980's. This made impact of 1990's reforms on growth unclear. Some believe that 1980's reforms were precursor to LPG reforms. Other things apart, it is clear that 1980 reforms led to crash of economy in 1991, which was remedied by LPG reforms which were quite more comprehensive. It was IMF loan which gave government to adjust its economy. It was largest ever loan given by IMF. Initially there were global doubts on India's credibility for loan, but India has been so far a disciplined borrower.

**Industrial Growth Rate –** Barring few years industrial growth rate has been not much impressive. Share of Industry still remains stagnantly low at 25%. Worst is that India has transitioned to be a service led economy, directly from an agrarian one. One expiation of this is end of policy of imports substitution which derived industrial growth upto 1990. Foreign companies got free access to Indian markets and made domestic products uncompetitive. They obviously had better access to technology and larger economies of scale. India's position also lagged on account of Research and innovation. Import substitution required certain degree of investment and efforts in domestic production. It was carried out even when imports were cheaper. This resulted in good and better capacity building upto that time. This was coupled with constant technology denial by west, which further pushed government to spend on R&D. Technology Denial ended with

liberalization and globalization. Till that time Indian Industry was better and modern than that of China. But in two decades China has surpassed India by huge margin in case of both Industry and innovation.

**Impact on Small Scale in India**

This impact shall be studied right from the beginning of colonization in 18th century. Colonization can be considered as 1st wave of globalization. In pre colonization era, India's textiles and handicraft was renowned worldwide and was backbone of Indian economy. With coming of industrial revolution along with foreign rule in India, Indian economy suffered a major setback and much of its indigenous small scale cottage Industry was destroyed.

After independence, government attempted to revive small scale sector by reserving items exclusively for it to manufacture. With liberalization list of reserved items was substantially curtailed and many new sectors were thrown open to big players.

Small scale industry however exists and still remains backbone of Indian Economy. It contributes to major portion of exports and private sector employment. Results are mixed, many erstwhile Small scale industries got bigger and better. But overall value addition, product innovation and technology adoption remains dismal and they exist only on back of government support. Their products are contested by cheaper imports from China. Policies of government toward SSI were covered in previous article access here and here

**Impact on Agriculture**

As already said, share of agriculture in domestic economy has declined to about 15%. However, people dependent upon agriculture are still around 55%. Cropping patterns has undergone a huge change, but impact of liberalization can't be properly assessed. We saw under series relating to agriculture that there are still all pervasive government controls and interventions starting from production to distribution.

Global agricultural economy is highly distorted. This is mainly because imbalance in economic and political power in hands of farmers of developed and developing countries. In developed countries, commercial and capitalistic agriculture is in place which is owned by influential agri-corporations. They easily influence policies of WTO and extract a better deal for themselves at cost of farmers of developing world.

Farming in developing world is subsistence and supports large number of poor people. With globalization there has been high fluctuation in commodity prices which put them in massive risk. This is particularly true for cash crops like Cotton and Sugarcane. Recent crises in both crops indicate towards this conclusively.

Also there is global Food vs. Fuel confusion going on. Sugar and corn are used to manufacture ethanol which is used as fuel. In USA Corn is produced mainly for this purpose, as sugar cane is in Brazil. Now there are apprehensions that what if converting food into fuel is more remunerative for producers? More than 1 billion people still live in hunger, much more are just hand to mouth. It is futile to expect that free market will take care of these people, who don't have any purchasing power. Clearly, Agriculture is biggest market failure, but is rarely discussed for being so in WTO. Another global debate born out of globalization is one of GM crops. Here too powerful MNCs like Monsanto hold the key. USA allows unhindered use of GM crops, but EU bans it. In India field trails are going on. (It was discusses here)

On the positive note, India's largely self-sufficient and high value distinguished products like Basmati Rice are in high demand all over. Generally speaking, India is better placed to take up challenge of globalization in this case. If done in sustainable and inclusive manner, it will have a huge multiplier impact on whole economy. Worldwide implicit compulsion to develop Food processing Industry is another landmark effect of globalization.

Apart from these, Farm Mechanization i.e. use of electronic/solar pumps, Tractors, combines etc. all are fruits of globalization. Now moving a step further, Information technology is being incorporated into agriculture to facilitate farming.

**Impact on Services Sector**

In this case globalization has been boon for developing countries and bane for developed

ones. Due to historic economic disparity between two groups, human resources have been much cheaper in developing economies. This was further facilitated by IT revolution and this all culminated in exodus of numerous jobs from developed countries to developing countries. Here US have to jealously guard its jobs as we guard our agriculture.

**IT industry**

Software, BPO, KPO, LPO industry boom in India has helped India to absorb a big chunk of demographic dividend, which otherwise could have wasted. Best part is that export of services result in export of high value. There is almost no material exported which consume some natural resource. Only thing exported is labor of Professionals, which doesn't deplete, instead grows with time. Now India is better placed to become a truly Knowledge Economy. Exports of these services constitute big part of India's foreign Exchange earnings. In fact, the only three years India had Current Account surplus, I.e. 2000-2002, was on back of this export only.

**Banking**

Further, in banking too India has been a gainer. Since reforms, there have been three rounds of License Grants for private banks. Private Banks such as ICICI, HDFC, Yes Bank and also foreign banks raised standards of Indian Banking Industry. Now there is cut through competition in the banking industry, and public sector banks are more responsive to customers. Here too IT is on path of bringing banking revolution. New government schemes like Pradhan Mantri Jan dhan Yojana aims to achieve their targets by using Aadhar Card. Having said this, Public Sector Banks still remain major lender in the country. Similarly Insurance Industry now offers variety of products such as Unit Linked Insurance plans, Travel Insurance etc. But, in India life Insurance business is still decisively in hands of Life Insurance Corporation of India.

**Stock Markets**

Another major development is one of Stock Markets. Stock Markets are platforms on which Corporate Securities can be traded real time. It provides mechanisms for constant price discovery, options for investors to exit from or enter into investment any time. These are back bone of free markets these days and there is robust trade going all over the world on stock exchanges. Their Importance can be estimated from the fact that, behavior of stock markets of a country is strongest indicator of health and future prospects of an economy.

These markets has thrown open wide array of associated services such as Investment Banking, Asset Management, Underwriting services, Hedging advice etc. These collectively employ lakhs of people all over India. Similarly there are commodities market which provides avenues for investment and sale of various eligible commodities.

**Telecom Sector**

Conventionally, Telecom sector was a government owned monopoly and consequently service was quite substandard. After reforms, private telecom sector reached pinnacle of success. And Indian telecom companies went global. However, corruption and rent seeking marred growth and outlook of this sector.

Entry of modern **Direct to Home** services saw improvements in quality of Television services on one hand and loss of livelihood for numerous local cable operators.

**Education and Health Sector**

It should be noted that food (Agriculture), Health and education (and to lesser extent banking) are among basic necessities, which every human being deserves and can't do without. Unfortunately, in developing countries there is market failure in all these sectors and majority of people can't afford beyond a certain limit (or can't afford at all). Concept of free markets, globalization, liberalization etc. fails here miserably. Free markets provide goods and services to people who can afford paying for them, not to those who deserve and need these.

Now if we consider these sectors from angle of our inclination towards free markets, certainly there has been lot of progress. There has been world class education available in India and Deregulation has resulted in Mushrooming of private engineering and Medical Colleges. But in reality, this had far reaching devastating effect on society.

These new colleges accommodate only a miniscule proportion of aspirants at very high costs. Recently, an Independent organization 'Transparency International' came out with report claiming that India's medical system is most corrupt in the world. This was no surprise, we all know from where it starts. High fees of education forces many aspirants to take educational loans from banks. After qualifying job market is unable to absorb majority of them. Practice turns out to be option of last resort. Now to make a decent living and to pay back the loans person is lured by corruption. Consequently, when many similar cases are put together, we get a corrupt system, economy and society.

Reality is that after deregulation and liberalization, government along with other sectors, pulled its hand from social sectors too. Now there is Mediocre to high quality options are available in private sector which can be availed as per one's budget. In public Sector Less than Mediocre to Mediocre options are available. This leaves huge proportion of aspiring students and expecting patients.

On Social front India's performance is deplored all over the world and it is probably behind all important developing economies. This lacuna has been recognized and government has taken the charge. In case of education almost universal enrollments has been achieved up to primary level and now impetus should be on improving quality, so that student of public schools comes at par with at least average private ones.

**Conclusion:**

The decades prior to 1991 may have been years of slow growth, but it is equally true that state-led growth did create capacities which enabled the economic reforms to reap the benefits of liberalization. At a time when the economy is still vulnerable to rainfall variation despite decades of agricultural growth, the issue of economic revival is not just about opening up the economy and liberalizing the trade environment.

The fundamental issues of inequality, lack of social progress and inability of the economy to generate jobs require a strategic response if the process of reforms and growth has to continue. It is time for the next generation of reforms—those that deal with the structural bottlenecks to growth—rather than more of the same.

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# LEATHER SCIENCE ABSTRACTS

**VOLUME 50** **NUMBER 02** **FEBRUARY, 2017**

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# LEATHER SCIENCE AND TECHNOLOGY

## LEATHER INDUSTRY. HISTORY. MANAGEMENT. ECONOMICS. EDUCATION

**50.15287**

Cluster bomb. SETTER (S), (Leather Intl.; 217, 4848; 2015, Mar.; 28&30).

Lashes out that the inefficiency and futility of not only the poor planning, but also the general ineptness of foresight by the relevant parties as more governments and industry bodies develop misguided plans to reignite their leather industries with new tannery clusters.

**50.15288**

Indian CRAMS players to cram in growth. (Chem. Wkly.; 60, 27; 2015, Feb., 10; 199-202).

Describes the CARE Ratings that expects Indian Contract Research Manufacturing Services(CRAMS) players to register strong growth rates-a CAGR of 18-20% by 2018. In the past with global innovators rationalizing inventories and reducing Research & Development to spend Indian players faced a gloomy phase. Going forward, factors like patent cliff, favorable currency and focus on new product development shall drive the growth. This augurs well for the credit profiles of the Indian CRAMS players in CARE Ratings' opinion. (3 Tab.; 2 Fig.).

**50.15289**

Market outlook : Indian master batches market set for higher growth trajectory. (Chem. Wkly.; 60, 33; 2015, Mar., 24; 215-6).

A master batch is a concentrated mix of pigments and/or additives encapsulated into a carrier polymer resin, which is then shaped into a granular form. This provides manufacturers of plastic products a convenient way to add colors/pigments or performance-enhancing additives to polymers at their own plant, thereby reducing stock holding and cleaning costs. The raw materials for master batch production include pigments, carriers, dispersants and some additives. Master batches are generally being used by several plastic processing methods including injection moulding, extrusion, blow moulding and others. It is used also for spinning and textile fibers. Discusses briefly about the benefits, types of master batches, Asia-Pacific-the key market, future growth drivers as well as the high fragmented Indian market. (1 Tab.; 1 Fig.; 1 Photo).

**50.15290**

Don Ohsman's view from the US. (Leather Intl.; 217, 4848; 2015, Mar.; 59-60).

It is very earnestly expected that the demand for raw-materials from USA should have to pick up again in China for the next term if not considerably beyond by looking ahead on it and this is not about to occur for keeping the prices even close to current levels. (1 Tab.; 4 Fig.).

**50.15291**

Building a business of speciality chemicals-Part 2 : Investment opportunities in the Indian chemical industry. (Chem. Wkly.; 60, 33; 2015, Mar., 24; 202-6).

Summarizes some of the key findings of the report by the Chemical Weekly commissioned Confederation of Indian Industry on the key raw materials-mainly derived from petrochemical sources. (3 Fig.).

**50.15292**

Making India a specialty chemicals hub : Potential and investment opportunities in the sector. PEREZ (J), (M/s. LANXESS India Private Limited, LANXESS House, Plot No. : A162-164 Road No. : 27, Maharashtra Industrial Development Corporation(MIDC), Wagle Estate, Thane(West)-400 604, Maharashtra State, India). (Chem. Wkly.; 60, 32; 2015, Mar., 17; 207-8).

It is found that India has a strong base in key specialty chemicals sectors like prints & coatings and agrochemicals. There is a trend wherein multinational companies are partnering with Indian manufacturers to cater to the global demand in a cost effective manner. Custom sourcing of agrochemicals and fine chemicals from India has been showing an increasing trend in recent years. This opportunity should be harnessed so as to create a strong technological and product base in India. But, it will become a possibility only if certain essentials are secured with an aim to gain a distinct competitive advantage. Lists and briefly discusses these essentials. Describes the progress and prosperity of M/s. LANXESS in India. (3 Photos).

**50.15293**

The OPEC impact on oil prices and implications for India. SABNAVIS (M), SACHDEVA (M), (CARE Ratings, M/s. Credit Analysis and Research Limited, Coliseum, Somaiya Hospital Road, Off. Eastern Express Highway, Sion(East), Mumbai-400 022, India). (Chem. Wkly.; 60, 23; 2015, Jan., 13; 206-7).

Discusses the impact of the Organization of the Petroleum Exporting Countries(OPEC) group on oil prices and their implications for India. (2 Tab.; 2 Photos).

**50.15294**

Economic impacts : End market products & technologies from rare earths-Part 2. (Chem. Wkly.; 60, 31; 2015, Mar., 10; 211-2).

Highlights the impacts on the end markets by revealing a significant role for these strategically important materials.

**50.15295**

The economic benefits of the rare earths industry. (Chem. Wkly.; 60, 28; 2015, Feb., 17; 201-11).

Defines briefly about the meaning of the term viz. : 'Rare Earths'. It is realized that the rare earth elements(with the exception of the radioactive promethium) are relatively plentiful in the Earth's crust. It is vital to various modern technologies including health care, clean energy environmental mitigation etc. These elements help to make many technologies for performing with reduced weight, reduced emissions and energy consumption; or give them greater efficiency performance, miniaturization, speed, durability and thermal stability. (2 Tab.; 1 Photo).

**50.15296**

India's proposed urea projects-are the targets achievable? VENKATRAMAN (S), (M/s. Nandini Consultancy(S) Private Limited, No. : 105, Cecil Street, 0601 The Octagon, Singapore-069834). (Chem. Wkly.; 60, 27; 2015, Feb., 10; 207-9).

Discusses that it may be appropriate for India to consider setting up urea projects in other regions in the world where feedstock would be readily available and energy costs would be low while it is very important that India become self-sufficient in the production of urea to the extent possible. Such projects can be set up as joint ventures, with firm commitment to supply the product to Indian market. One is not sure as to whether the government has considered these options, while chalking out plans for setting up new urea projects and revival of the closed ones. (1 Tab.; 3 Photos).

**50.15297**

Market trends : Rising energy consumption & environmental concerns driving markets for refinery catalysis. (Chem. Wkly.; 60, 26; 2015, Feb., 3; 193-4).

It is noted that the world oil refinery industry is a continually changing business. This presents an ever-evolving challenge to the refiner and requires the ability to be flexible, adaptable and aware of the future directions and changes the industry will take. Refinery catalysis have found wide acceptance in the oil refining industry. Steady economic growth, rising environmental concerns and increasing energy consumption remain the key driving forces in the market. The market of refinery catalysts are broadly segmented into zeolites, metals and chemical compounds, on the basis of ingredients. The major categories of refinery catalysts are (a) fluid catalytic cracking(FCC); (b) hydrotreating; (c) hydrocracking; (d) alkylation etc. Describes briefly about the market and regional trends; key drivers & restraints; technological developments and market players. (1 Tab.; 3 Fig.).

**50.15298**

Renewable Energy-Wind Energy : Re-introduction of accelerated depreciation key for growth. MAJUMDAR (S), KADAM (G), VIKRAM (V), (M/s. ICRA Research Services, Registered Office, No. : 1105, Kailash Building, 11th Floor, No. : 26, Kasturba Gandhi Marg, New Delhi-110 001, India). (Chem. Wkly.; 60, 31; 2015, Mar., 10; 203-4).

It is expected that the annual capacity addition during the current Financial Year 2015 to improve to about 2200-2300-Mega Watt(MW), implying growth of about 10% over the previous year, which is supported by reintroduction of Accelerated Depreciation(AD) benefit by Government of India (GOI) since July 2014 & sizeable investments under implementation by large players in the Independent Power Producers (IPP) segment. The expectations covered also that the cooperate customers availing AD benefit to have relatively more favorable project economics; key regulatory developments on tariff norms by state electricity regulatory commission (SERC); Renewable purchase obligation (RPO) norms that continue to deviate significantly; overall RPO compliance which is a key challenge and the amendments in REC(Renewable Energy Certificates) norms which are a positive for the sector. It is viewed that any improvement in REC market would be crucially dependent upon strict enforcement of penalty framework of SERCs, as well as an improvement in the financial conditions of the distribution utilities, which are key obligated entities. (1 Photo).

**50.15299**

Import/export : barely legal operations? SOTHMANN (S), (USHSLA(United States Hide, Skin and Leather Association), No. : 1150 Connecticut Avenue, Northwest, 12th Floor, Washington 20036, District of Columbia and ICHSLTA(International Council of Hides, Skins and Leathers Trade Association), Room No. : 2302, 23rd Floor, Caroline Center, No. : 28 Yun Ring Road, Hong Kong). (Leather Intl; 217, 4848; 2015, Mar.; 7-8&10).

It is questioned that whether hide and skin export restrictions could actually be illegal with the shifting landscape of free trade agreements and the World Trade Organization(WTO). (4 Photos).

**50.15300**

Standard procedure. JIANG (J), (M/s. SGS Global Softlines Services, SGS Headquarters, 1 Place des Alpes P.O. Box 2152 1211 Geneva 1, Switzerland). (Leather Intl; 217, 4848; 2015, Mar.; 49-50&52).

Examines China's leather market standard, opportunities and solutions with current market challenges in Asia impacting the leather industry. (3 Tab.; 2 Photos).

**50.15301**

Bring back the shine. GATHANJU (D), (Leather Intl; 217, 4848; 2015, Mar.; 56-7).

Examines the way in which Kenya is embarking on reviving its leather industry as the nation is aiming to transform into a new industrialized, clean and secure middle-income country providing a high quality of life to its citizens on framing the Kenya Vision 2030. (1 Photo).

**50.15302**

The big connect-Shale revolution and expansion of Panama Canal. SRIVASTAVA (P), (M/s. Markets & Markets, UNIT No. : 802, Tower No. : 7 SEZ Magarpatta City, Hadapsar, Pune-411 013, Maharashtra State, India). (Chem. Wkly.; 60, 26; 2015, Feb., 3; 216-8).

The shalk revolution in the United States has the potential to make the country one of the world's large exporters of liquefied petroleum gas(LPG). On top of that the Panama Canal expansion is going to improve the competitive position of LPG exports from the US, while providing buyers in Asia with more opportunities to source supply. Aims the highlight of how expansion of the Panama Canal will benefit Asian LPG buyers in the context of US shale revolution. (2 Tab.; 1 Fig.; 2 Photos).

**50.15303**

Concept mapping on by product utilization. ANANTHARAMAN (L), (Computer Center, Council of Scientific and Industrial Research-Central Leather Research Institute(CSIR-CLRI), Adyar, Chennai-600 020, India). (Leather News India; 6, 2; 2015, Feb.; 74-81).

Concept maps are tools for organizing and representing knowledge. Concepts and propositions are the building blocks for knowledge in any domain. There are two features of concept maps that are important in the facilitation of creative thinking namely the hierarchical structure that is represented in a good map and the ability to search for and characterize cross-links. Cross-links help one to see how some domains of knowledge represented on the map are related to each other. Cross-links often represent creative leaps on the part of the knowledge producer in the creation of new knowledge. Attempts a curriculum or instruction on a specific topic helps to make the instruction "conceptually transparent" to students by using concept maps in planning. The make of a concept map on Utilization of Byproducts. Focuses the question, viz. : Byproducts Utilization-Sources-End products-Application areas-Methods of extraction. (9 Ref.; 1 Tab.; 11 Fig.; 1 Flow Chart).

**50.15304**

eGov-_SD_eSTEM for leather industry. ANANTHARAMAN (L), (Computer Center, Council of Scientific and Industrial Research-Central Leather Research Institute(CSIR-CLRI), Adyar, Chennai-600 020, India). (Leather News India; 6, 3; 2015, Mar.; 57-60).

Proposes a conceptual framework for eGov_SD_eSTEM. Electronic Governance(eGov) research studies the use of Information and Communication Technologies (ICTs) to improve Governance processes. Sustainable Development (SD) research studies possible development routes that satisfy the needs of the present generation without compromising the ability of the future generations to meet their own needs. STEM represents the fields of study in the categories of Science, Technology, Engineering and Mathematics. eSTEM represents environmental STEM and also eLearning on STEM. Despite substantial progress in all these domains independently, little research exists at their intersection on how to utilize eGov in support of SD and eSTEM in meeting the requirements of eGovernance for an industry. This intersection is being called as Electronic Governance for Sustainable Development and eSTEM as eGov_SD_eSTEM. (6 Ref.; 2 Tab.; 11 Fig.).

**ENZYMOLOGY**

**50.15305**

The optimization of some extracellular enzymes biosynthesis by *Aspergillus niger 377-4*. WIKIERA (A), MIKA (M), JANISZEWSKA (AS), ZYLA (K), (Department of Food Biotechnology, Faculty of Food Technology, Agricultural University Balicka 122, 30-149 Cracow, Poland). (J. Sci. Ind. Res.; 74, 3; 2015, Mar.; 145-9).

Studied the effect of initial solid and moisture contents, temperature and time of incubation on the production of polygalacturonase, phytase, acid phosphatase, xylanase and â–glucanase by *Aspergillus niger 377-4* during solid state fermentation. Optimized the parameters of enzyme synthesis using statistical experimental designs. It was shown that the capacity of strain to synthesize the aforementioned enzymes could be modified within a wide range by culture parameters selection. Achieved the optimal polygalacturonase production efficiency with the initial medium mass of 19.9 g and humidity of 59.9%, after 77.7 hours of incubation at 28.9°Centigrade. The best combination of culture parameters for phytase synthesis was : initial medium mass 19.9 g, moistures 50%, temperature 33°Centigrade and incubation time 83.9 hours. Obtained the highest activity of acid-phosphatase after 81.3 hour of incubation at 27°Centigrade, with initial substrate mass of 17.8 and moisture content of 60%. The initial solid and moisture contents to synthesize xylanase were 19.9g and 50%, respectively, with incubation time of 73 hours at 29.6°Centigrade. Obtained the highest efficiency of â–glucanase biosynthesis when *Aspergillus niger 377-4* was cultivated for 80.4 hours at 27°Centigrade on an initial medium mass of 20 g and initial level of moistness 59. 9%. (15 Ref.; 5 Fig.).

**50.15306**

A small-molecular protein-protein interaction inhibitor of PARP1 that targets its BRCT domain. NA (Z), PENG (B), NG (S), PAN (S), LEE (J), SHEN (H), YAO (SQ), (Department of Chemistry, National Institute of Singapore, 3 Science Drive 3, Singapore 117543, Singapore). (Angew. Chem.; 54, 8; 2015, Feb., 16; 2515-9).

Describes poly (ADP-ribose) polymerase-1(PAR1) as a BRCT-containing enzyme (BRCT=BRCA1 C-terminus) mainly involved in deoxyribonucleoroacid) repair and damage response and validated target for cancer treatment. Small-molecule inhibitors that target the PAR1 catalytic domain have been actively pursued as anticancer drugs, but are potentially problematic owing to a lack of selectivity. Compounds that are capable of disrupting protein-protein interactions of PARP1 provide an alternative by inhibiting its activities with improved selectivity profiles. Discovered that a natural product viz. : (±)-gossypol with a number of known biological activities, possesses novel PARP1 inhibitory activity both in vitro and in cancer cells and presumably acts through disruption of protein-protein interactions by establishing a high-throughput microplate-based assay suitable for screening potential PPI inhibitors of the PARP1 BRCT domain. It is further established that (-)-gossypol was likely the causative agent of PARP1 inhibition by promoting the formation of a 1:2 compound/PARP1 complex by reversible formation of a covalent imine linkage as the first known cell-permeable small-molecule PPI inhibitor of PARP1. (27 Ref.; 13 Fig.).

**LEATHER CHEMICALS AND AUXILIARIES**

**50.15307**

Heterogeneous water oxidation : surface activity versus amorphization activation in cobalt phosphate catalysts. GONZÁLEZ-FLORES (J), SÁNCHEZ (I), ZEHARIEVA (I), KLINGAN (K), HEIDRKAMP (J), CHERNEV (P), MENEZES (PW), DRIES (M), DAU (H), MONTENO (ML), (Department of Physics, Freie Universität Berlin, Arnimallee 14, 14195 Berlin, Germany). (Angew. Chem.; 54, 8; 2015, Feb., 16; 2472-6).

Addressed the question viz. : "Is water oxidation catalyzed at the surface or within the bulk volume of solid oxide materials? For cobalt phosphate catalysts deposited on inert electrodes, namely crystallites of pakhomovskyite($Co_3(PO_4)_2{\cdot}8H_2O$,Pak) and phosphate containing Co oxide(CoCat). X-ray spectroscopy reveals that oxidizing potentials transform the crystalline Pak slowly(5-8 hours) but completely into the amorphous CoCat. Electrochemical analysis supports high-TOF(turnover frequency) surface activity in Pak, whereas its amorphization results in dominating volume activity of the thereby formed CoCat material. Volume catalysis prevails in the directly electrodeposited CoCat, but not at very low levels of the amorphous material, implying high-TOF catalysis at surface sites. A complete picture of heterogeneous water oxidation requires insight in catalysis at the electrolyte-exposed "outer surface", within a hydrated, amorphous volume phase and modes and kinetics of restructuring upon operation. (41 Ref.; 11 Fig.).

**50.15308**

A nanoparticle catalyst for heterogeneous phase para-hydrogen-induced polarization in water. GLÖGGLER (S), GRUNFELD (AM), ERTAS (YN), McCORMICK (J), WAGNER (S), SCHLEKER (PPM), BOUCHARD (L), (Department of Chemistry and Biochemistry, University of California at Los Angeles, 607 Charles E Young Drive East, Los Angeles 90095-1569, USA). (Angew. Chem.; 54, 8; 2015, Feb., 16; 2452-6).

Describes the para-hydrogen-induced polarization(PHIP), as a technique capable of producing spin polarization at a magnitude far greater than state-of-the art magnets. A significant application of PHIP is to generate contrast agents for biomedical imaging. Clinically viable and effective contrast agents not only require high levels of polarization but heterogeneous catalysts that can be used in water to eliminate the toxicity impact. Demonstrated the use of Pt(platinum) nanoparticles capped with glutathione to induce heterogeneous PHIP in water. The ligand-inhibited surface diffusion on the nanoparticles resulted in a $^{1}H$ polarization of p=0.25% for hydroxyethyl propionate, a known contrast agent for magnetic resonance angiography(MRA). Transferring the $^{1}H$ polarization to a $^{13}C$ nucleus using a para-hydrogen polarizer yielded polarization of 0.013%. The nuclease spin polarization achieved in those experiments are the first reported to date involving heterogeneous reactions in water. (35 Ref.; 13 Fig.).

**50.15309**

Growth and Origami folding of DNA on nanoparticles for high-efficiency molecular transport in cellular imaging and drug delivery. YAN (J), HU (C), WANG (P), ZHAO (B), OUYANG (X), ZHOU (J), LIU (R), HE (D), FAN (C), SONG (B), (National Engineering Research Center for Nanotechnology, No. : 800 Dongchuan Road, Minhang District, Shanghai 200241, China). (Angew. Chem.; 54, 8; 2015, Feb., 16; 2431-5).

Describes the development of a novel three-dimensional(3D) superstructure based on the growth and origami folding of deoxyribonucleoroacid(DNA) on gold nanoaprticles(AuNPs). The 3D superstructure contains a nanoparticle core and dozens of two-dimensional DNA belts folded from long single-stranded DNAs grown *in situ* on the nanoparticle by rolling circle amplification(RCA). Designed two machines to

achieve the loading of molecules onto the 3D superstructures. Ligands bound to target molecules are merged into the growing DNA during the RCA process(merging mechanism) in one mechanism and the target molecules are intercalated into the double-stranded DNAs produced by origami folding (intercalating mechanism) in the other mechanism. Demonstrated that the as-fabricated 3D superstructures have a high molecule-loading capacity and that they enable the high-efficiency transport of signal reporters and drugs for cellular imaging and drug delivery, respectively. (45 Ref.; 13 Fig.; 1 Scheme).

**50.15310**

Antibody activation using DNA-based logic gates. JANSSEN (BMG), van ROSMALEN (M), van BEEK (L), MERKX (M), (Laboratory of Chemical Biology and Institute for Complex Molecular Systems, Eindhoven University of Technology, De Random 70, 5612 AP Eindhoven, The Netherlands). (Angew. Chem.; 54, 8; 2015, Feb., 16; 2530-3).

Discusses that oligonucleotide-based molecular circuits that offer the exciting possibility to introduce autonomous signal processing in biomedicine, synthetic biology and molecular diagnostics. Introduced the bivalent-peptide-DNA(deoxyribonucleoroacid) conjugates as generic, noncovalent and easily applicable molecular locks that allow the control of antibody activity using toehold-mediated strand displacement reactions. Demonstrated the reversible control of antibody targeting with low nM(nanomolar) concentrations of peptide-DNA locks and oligonucleotide displacer strands by employing yeast as a cellular model system. Introduction of two different inputs, yielding logic OR- and AND gates. The range of molecular inputs could be further extended to protein-based triggers by using protein-binding aptamer. (34 Ref.; 16 Fig.; 1 Scheme).

**50.15311**

Formation of DNA:RNA hybrid G-Quadruplex in bacterial cells and its dominance over the intramolecular DNA G-Quadruplex in mediating transcription termination. WU (R), ZHENG (K), ZHANG (J), HAO (Y), TAN (Z), (State Key Laboratory of Biomembrane and Membrane Biotechnology, Institute of Zoology, Chinese Academy of Sciences(CAS), Lincui East Road, AoCdunCun, Chaoyang Qu, Beijing Shi, Beijing 100101, People's Republic of China). (Angew. Chem.; 54, 8; 2015, Feb., 16; 2447-51).

Describes the DNA(deoxyribonucleoroacid) with four guanine tracts that can fold into G-quadruplexes and that are targets of transcription regulation. It is recently found that hybrid DNA:RNA(ribonucleoroacid) G-quadruplexes(HQs) can form during in vitro transcription. However, it is unclear whether they conform in cells. Presents the evidence which is supporting their formation in plasmids in bacterial cells. Indicated the formation of the GQs by an unique pattern of prematurely terminated transcripts under two conditions where the RNA transcripts do or do not participate in G-quadruplex assembly and further supported by a number of chemical and biochemical analysis. HQs dominate over the intramolecular DNA G-quadruplexes (DNA DQs) in mediating the transcription termination when both structures are able to form. These findings provide the first evidence of HQ formation in cells and suggest that the competition/conversion between HQ and DQ may regulate transcription and serve as drug target in pharmaceutical applications. (19 Ref.; 10 Fig.).

**50.15312**

Response surface methodology for the optimization of Kojic acid production by *Aspergillus flavus* using Muntingia calabura fruits as a carbon source. BALADURGA DEVI (K), VIJAYALAKSHMI (P), SHILPA (V), PRASAD T (VSSL), VEERENDRA KUMAR (B), (Department of Biotechnology, GITAM Institute of Sciences, GITAM University, Beach Road, Gandhi Nagar, Rushikonda, Visakhapatnam-530 045, Andhra Pradesh State, India). (Indian J. Sci. Technol.; 8, 6; 2015, Mar.; 556-61).

Focuses the optimization of kojic acid production by a soil isolated fungal organism *Aspergillus flavus* through Surface Fermentation(SF) by utilizing a novel carbon source i.e. ripened fruits of *Muntingia calabura L*. Initially the most significant 7 physico-chemical factors were studied for the optimization process through One-Factor-At-A-Time Method(OFAT). Among these 5 influential factors were screened and five-factor-three-level Central Composite Design(CCD) matrix and Response Surface Methodology(RSM) was performed to enhance the production rate of kojic acid. Through one-factor-at-a-time method the optimal values were Substrate concentration 100g/L, Peptone concentration 4g/L, $KH_2Po4$ concentration 2g/L, MgSo4 concentration 0.7 g/L, *p*H 6.0, Time 28 d and Temperature 30°Centigrade and the maximum kojic acid production was 85.1 g/L. The maximum production obtained at the predicted optimal conditions through response surface methodology was Substrate concentration 100g/L, Peptone concentration 4g/L, *p*H 6.0, Time 28d and Temperature 29°Centigrade and the maximum kojic acid production was 88.8 g/L. These results direct to the success of the model in improving a process for the production of kojic acid, a significant organic acid with vast industrial importance. (7 Ref.; 4 Tab.; 5 Fig.).

**50.15313**

A synthetic adenylation domain-based tRNA-aminoacylation catalyst. GIESSEN (TW), ALTEGOER (F), NEBEL (AJ), STEINBACH (RM), BANGE (G), MARAHIEL (MA), (Department of Chemistry, Philipps-University Marburg, Hans-Mecrwein-Strasse 4, 35032 Marburg, Germany). (Angew. Chem.; 54, 8; 2015, Feb., 16; 2492-6).

Discusses the incorporation of non-proteinogenic amino acids that represents a major challenge for the creation of functionalized proteins. The ribosomal pathway is limited to the 20-22 proteinogenic aminoacids while nonribosomal peptide synthetases(NRPSs) are able to select from hundreds of different monomers. Introduced herein is a fusion-protein-based design for synthetic transparent ribonucleoroacid(tRNA)-aminoacylation catalysts based on combining NRPS adenylation domains and a small eukaryotic tRNA-binding domain(Arc1p-C). The adenylation domain PheA was fused with Arc1p-C using flexible linkers and achieved tRNA-aminoacylation with both proteinogenic and non-proteinogenic amino acids by using national design, guided by structural insights and molecular modeling. The resulting aminoacyl-tRNAs were functionally validated and the catalysts showed broad substrate specificity towards the acceptor tRNA. This strategy shows how functional tRNA-aminoacylation catalysts can be created for bridging the ribosomal and nonribosomal worlds. This opens up new avenues for the aminoacylation of tRNAs with functional non-proteinogenic amino acids. (37 Ref.; 10 Fig.).

**50.15314**

Nucleophilic addition of amines to ruthenium carbenes : *Ortho*-(Alkynyloxy)benzylamine cyclizations towards 1,3-benzoxazines. GONZÁLEZ-RODRIGUEZ (C), SUÁREZ (JR), VARELA (JA), SAÁ (C), (Departamento de Quimica Organica y Centro Singular de Investigación en Quimica Biologica y Materiales Moleculares(CIQUS), Universidad de Santiago de Compstela, Rectorado, Praza do Obradoiro, s/n, 15782 Santiago de Compostela, Spain). (Angew. Chem.; 54, 9; 2015, Feb., 23; 2724-8).

Reports a new ruthenium-catalyzed cyclization of *Ortho*-(alkynyloxy)benzylamies to dihydro-1,3-benzoxazines. The cyclization is thought to take place via the vinyl ruthenium carbine intermediates which are easily formed from [Cp*RuCl(cod)] and $N_2CHSiMe_3$. The mild reaction conditions and the efficiency of the procedure allow the easy preparation of a broad range of new 2-vinyl-2-substituted 1,3-benzoxyazine derivatives. Rearrangement of an internal C(sp) in the starting material into a tetrasubstituted $C(sp^3)$ atom in the final 1,3-benzoxazine is highly remarkable. (67 Ref.; 3 Tab.; 2 Schemes).

**50.15315**

Intercalation of highly dispersed metal nanoclusters into a layered metal oxide for photocatalytic overall water splitting. OSHIMA (T), LU (D), ISHITANI (O), MAEDA (K), (Department of Chemistry, Graduate School of Science and Engineering, Tokyo Institute of Technology, 2-12-1-NE-2 Oakayama, Meguru-ku, Tokyo 152-8550, Japan). (Angew. Chem.; 54, 9; 2015, Feb., 23; 2698-702).

Metal nanoclusters(involving metals such as platinum) with a diameter smaller than 1 nm were deposited on the interlayer nanospace of $KC_2Nb_3O_{10}$ using the electrostatic attraction between a cationic metal complex(e.g.$[Pt(NH_3)_4]Cl_2$ and a negatively charged two-dimensional $Ca_2Nb_3O_{10}^{-1}$ sheet, without the aid of any additional reagent. The material obtained possessed eight-fold greater photocatalytic activity for water splitting into $H_2$ and $O_2$ under land-gap irradiation than the previously reported analog using a $RuO_2$ promoter. This study highlighted the superior functionality of Pt(Platinum) nanoclusters with diameters smaller than 1 nm for photocatalytic overall water splitting. This material shows the greatest efficiency among nanosheet-based photocatalysts reported to date. (57 Ref.; 3 Fig.; 1 Scheme).

**50.15316**

Synergistic interplay of a non-heme iron catalyst and amino acid coligands in $H_2O_2$ activation for asymmetric epoxidation of á–alkyl-substituted styrenes. CUSSÓ (O), RIBAS (X), LLORET-FILLOL (J), COSTAS (M), (Institut de Quimica Computacional i Catalisi(IQCC) and Department de Quimica, Universitat de Girona, Campus de Montilivi, Facultat de Ciencies, dispatch C3-175, 17071 Qirona, Catalonia, Spain). (Angew. Chem. 54, 9; 2015, Feb., 23; 2729-33).

Describes the highly enantioselective epoxidation of á–substituted styrenes with aqueous $H_2O_2$(hydrogen peroxide) by using a chiral iron complex as the catalyst and N-protected amino acids(AAs) as coligands. The amino acids synergistically cooperate with the iron center in promoting an efficient activation of $H_2O_2$ to catalyze epoxidation of this challenging class of substrates with good yields and stereoselectivities(up to 97% ee(enantioexcess)) in short reaction times. (51 Ref. ;2 Tab.; 1 Fig.; 2 Schemes).

**50.15317**

Mapping conformational heterogeneity of mitochondrial nucleotide transporter in uninhibited states. SOUNIER (R), BELLOT (G), CHOU (JJ), (Department of Biological Chemistry and Molecular Pharmacology, Harward Medical School, No. : 25 Shattuck Street, Boston, Massachusetts 02115, USA). (Angew. Chem.; 54, 8; 2015, Feb., 16; 2436-41).

One of the less well understood aspects of membrane transporters is the dynamic coupling between conformational change and substrate transport. Investigates the conformational heterogeneity of the GTP/GDP(guanosine triphosphate/guanosine diphosphate) carrier (GGC) from yeast mitochondria by using the NMR(nuclear magnetic resources) approaches.

NMR residual dipolar coupling (RDC) analysis of GGC in a deoxyribonucleoroacid (DNA)-origami nanotube liquid crystal shows that several structured segments have different generalized degrees of order(GDO), thus indicating the presence of conformational heterogeneity. Complete GDO mapping reveals asymmetry between domains of the transporter and even within certain transmembrane helices. Nucleotide binding partially reduces local structural heterogeneity and the substrate binds to multiple sites along the transport cavity. These observations suggest that mitochondrial carriers in the uninhibited states are intrinsically plastic and structural plasticity is asymmetrically distributed among the three homologous domains. (34 Ref.; 9 Fig.).

**50.15318**

Visible light-driven $CO_2$ reduction with carbon nitride : Enhancing the activity of ruthenium catalysts. KURIKI (R), SEKIZAWA (K), ISHITANI (O), MAEDA (K), (Department of Chemistry, Graduate School of Science and Engineering, Tokyo Institute of Technology, 2-12-1-NE-2 Ookayama, Meguro-ku, Tokyo 152-8550, Germany). (Angew. Chem.; 54, 8; 2015, Feb., 16; 2406-9).

Describes the development of a heterogeneous photocatalyst system that consists of a ruthenium complex and carbon nitride($C_3N_4$), which act as the catalytic and light-harvesting units, respectively, for the reduction of $CO_2$(carbondioxide) into formic acid. Promoting the injection of electrons from $C_3N_4$ into the ruthenium units as well as strengthening the electronic interaction between the two units enhanced its activity. The use of suitable solvent further improved the performance, resulting in a turnover number of greater than 100 and an apparent quantum yield of 5.7% at 400 nm. These are the best values that have been reported for heterogeneous photocatalysts for $CO_2$ reduction under visible-light irradiation to date. (33 Ref.; 1 Tab.; 1 Fig.; 1 Scheme).

**50.15319**

Hydrogenations at room temperature and atmospheric pressure with Mesoionic carbine-stabilized borenium catalysts. EISENBERGER (P), BESTVATER (BP), KESKE (EC), CRUDDEN (CM), (Department of Chemistry, Queen's University, No. : 99 Bader Lane, Kingston, Ontario K7L 3N5, Canada). (Angew. Chem.; 54, 8; 2015, Feb., 16; 2467-71).

Describes the synthesis of 1,2,3-Triazolylidene-based mesoionic carbine borenes in a convenient one-pot protocol from the corresponding 1,2,3-triazolium salts, base and borane. Borenium ions are obtained by hydride abstraction and serve as catalysts in mild hydrogenation reactions of imines and unsaturated N-heterocycles at ambient pressure and temperature. (42 Ref.; 1 Tab.; 4 Fig.; 3 Schemes).

**50.15320**

Stereoselective synthesis of highly functionalized indanes and dibenzocycloheptadienes through complex radical cascade reactions. KONG (W), FUENTES (N), GARCIA-DOMINGUEZ (A), MERINO (E), NEVADO (C), (Department of Chemistry, University of Zürich, Winterthurerstrasse 190, 8050 Switzerland). (Angew. Chem.; 54, 8; 2015, Feb., 16; 2487-91).

Presents two highly stereoselective radical-mediated syntheses of densely functionalized indanes and dibenzocycloheptadienes from ortho-vinyl- and ortho-vinylaryl-substituted N-(arylsulfonyl)-acrylamides, respectively. The chemoselective addition of *in situ* generated radicals(X) onto the styrene moieties triggers an unprecedented reaction cascade, resulting in the formation of one new C-X bond(haloalkenes) and two new C-C(Carbon-Carbon) bonds, a formal 1,4-aryl migration and the extrusion of $SO_2$(sulfur dioxide) to generate an amidyl radical intermediates. This intermediate, upon H(hydrogen) abstraction leads to the observed 5 – and 7-membered ring carbocyclic products, respectively, in a highly efficient manner. (80 Ref.; 2 Tab.; 3 Schemes).

**50.15321**

Opportunities for refineries : Valorise aromatics and olefins for higher-value chemicals; don't consign to fuels. SHARMA (NM), (Institute of Chemical Technology(ICT), Nathelal Parekh Marg; Matunga(C.Rly.), Mumbai-400 019, India). (Chem. Wkly.; 60, 29; 2015, Feb., 24; 197-8).

It is stated through a speech by the author that the petroleum refining companies in India are sure to do well in future to gainfully utilize every fraction of crude oil coming from its refineries and use of olefins and aromatics for the production of higher value chemicals, instead of just consigning them to fuels. It will need a change in mindset of petroleum refineries, who have long been obsessed with catering to demand for fuels. Highlighted several opportunities for hydrocarbon companies in the area of downstream chemicals, starting with gainful exploitation of refrigeration that comes with Liquid Natural Gas(LNG) imported at receiving terminals and also for isolation and valorization of the C5 streams coming from refineries. Urged greater adoption of the far more efficient catalytic cracking of

propane as opposed to the more widely practiced thermal cracking, which has a maximum conversion of 60%. It is viewed that stranded natural gas can be converted to diesel via Fischer-Tropsch technology. (1 Tab.; 1 Photo).

**50.15322**

Sensitive and multiplexed On-chip microRNA profiling in oil-isolated hydrogel chambers. LEE (H), SRINIVAS (RL), GUPTA (A), DOYLE (PS), (Department of Chemical Engineering, Massachusetts Institute of Technology, No. : 77 Massachusetts Avenue, Cambridge, Massachusetts 02139, USA). (Angew. Chem.; 54, 8; 2015, Feb., 16; 2497-81).

Describes the current profiling platforms that are insignificant for clinical translation although micro ribonucleoroacids(microRNAs) have been shown to be excellent indicators of disease state. Demonstrates a versatile hydrogel-based microfluidic approach and novel amplification, scheme for entirely on-chip, sensitive and highly specific miRNA detection without the risk of sequence bias. A simulation-driven approach is used to engineer the hydrogel geometry and the gel-reaction environment is chemically optimized for robust detection performance. The assay provides 22.6 fM sensitivity over a three log range, demonstrates multiplexing across at least four targets and requires just 10.3 ng of total RNA input in a 2 hour and 15 minutes assay. (38 Ref.; 6 Fig.).

**50.15323**

Optimal cultivation of *Scenedesmus sp.* microalgae in a bubble column photobioreactor. BAKUEI (N), AMINI (G), NAJAFPOUR (GD), JAHANSHAHI (M), MOHAMMADI (M), (Biotechnology Research Laboratory, Faculty of Chemical Engineering, Babol Noshirvani University of Technology, Babol, Mazandaranneka, Shariati Street, Iran). (Indian j. Chem. Technol.; 22, 1-2; 2015, Jan.-Mar.; 20-5).

Investigates the influence of several factors including salinity, *p*H, lamps with various light intensities and different water resources on the growth of isolated *Scenedenmus sp.* microalgae. Obtained the maximum growth of *Scenedesmus sp.*(3.71 $gL^{-1}$) in the fabricated bubble column photobioreactor and under illumination of tungsten light at *p*H value of 8 and salinity of 3.6 psu. Investigates also the growth model for microalgae by using Logistic model. The obtained data fits well with the projected model. The maximum specific growth rate, initial biomass concentration and apparent specific growth rate($x_{max}$, $x_p$ and $K_c$) are found to be 3.5, 0.002 g $L^{-1}$ and 0.63 $d^{-1}$, respectively. Analyzed the extracted fatty acids from microalgae by GC(gas chromatography). It has been found that about 43.71% of oil content of microalgae is oleic acid(c18:1) which improves oxidative stability properties of biodiesel feed-stock. (39 Ref.; 1 Tab.; 8 Fig.).

**50.15324**

Rhodium-catalyzed(5+1) annulations between 2-alkenylphenols and allenes : A practical entry to 2,2-disubstituted *2H*-chromenes. CASANOVA (N), SEOANE (A), MASCARENAS (JL), GULIAS (M), (Centro Singular de Investigación en Quimica Bioloxica en Quimica Bioloxica e Materiais Moleculares(CUQUS) and Departamento de Quimica Organica 15782, Universidade de Santiago de Compstela, Rectorado, Praza do Obradoiro, s/n, 15782 Santiago de Compostela A.Coruña, Spain). (Angew. Chem.; 54, 8; 2015, Feb., 16; 2374-7).

Describes the readily available alkenylphenols that react with allenes under rhodium catalysis to provide valuable 2,2-disubstituted 2*H*-chromines. The whole process, which involves the cleavage of one C-H(Carbon-Hydrogen) bond of the alkenyl moiety and the participation of the allene as a one-carbon cycloaddition partner, can be considered a simple, versatile and atom-economical(5+1)

heteroannulation. The reaction tolerates a broad range of substituents both in the alkenylphenol and in the allene and most probably proceeds through a mechanism involving a rhodium-catalyzed coupling followed by two sequential pericyclic processes. (47 Ref.; 2 Tab.; 1 Fig.; 3 Schemes).

**50.15325**

Ligand-controlled regiodivergent palladium-catalyzed decarboxylative allylation reaction to access á,á-difluoroketones. YANG (M), ORSI (DL), ALTMAN (RA), (Department of Medicinal Chemistry, University of Kansas, 1251 Wescoe Hall Drive, Lawrence, Kansas 66045, USA). (Angew. Chem.; 54, 8; 2015, Feb., 16; 2361-5).

Describes the á,á-Difluoro ketones that possess unique physicochemical properties that are useful for developing therapeutics and probes for chemical biology. Discusses the complementary palladium-catalyzed decarboxylative allylation reactions that have been developed to provide linear and branched á-allyl-á,á-difluoroketones for accessing the á-allyl-á,á-difluoroketone substructure. The florination pattern of the structure enabled the ligands to dictate the regioselectivity of the transformations for these orthogonal processes. (55 Ref.; 1 Tab.; 3 Fig.; 2 Schemes).

**50.15326**

Surge analysis of ethylene cross-country pipeline. SRINIVASAN (P), MOHAN (A), (M/s. Technip India Limited, Chennai Operating Center, No. : 19 Velachery Main Road, Guindy, Chennai-600 032, India). (Chem. Wkly.; 60, 27; 2015, Feb., 27; 203-6).

Discusses the importance of surge study and illustrates few case studies from previous project experience on how sudden closure of Emergency Shutdown Device(ESD) leads to pressure surge in the pipeline. Transient simulation study was carried out for several cases of the ESD closing time and finalized the closing time of ESD at which surge pressure was less than the design pressure of the pipeline from one of the previous projects involving 5.5 km long ethylene cross-country pipeline. Illustrated and discussed the pressure profile graph generated from computerized simulation study at various closing time ESD. (7 Fig.).

**50.15327**

Modulation of benzene or naphthalene binding to palladium cluster sites by the backside-ligand effect. ISHIKAWA (Y), KIMURA (S), TAKASE (K), YAMAMOTO (K), KRASHIGE (Y), YANAI (T), MURAHASHI (T), (Research Center of Integrative Molecular Systems(CiMos), Institute for Molecular Science, National Institute of Natural Sciences, Myodaiji, Okazaki, Aichi, 444-8787, Japan). (Angew. Chem.; 54, 8; 2015, Feb., 16; 2482-6).

Reports the backside-ligand modulation strategy to enhance the substrate binding property of Pd(palladium) clusters. The benzene or naphthalene binding ability of $Pd_3$ or $Pd_4$ clusters is enhanced significantly by the backside cycloocatetraene ligand, leading to the formation of the solution-stable benzene- or naphthalene Pd clusters. The present results imply that the ligand design of the metal clusters, especially for the backside ligand of the metal cluster site, is crucial to acquire a desired reactivity of metal clusters. (52 Ref.; 6 Fig.; 6 Schemes).

**PRE-TANNING MATERIALS**

**50.15328**

Waterborne dimethylolpropionic acid-diisocyanate adducts with alkali-diblockable isocyanate groups as pretanning agent for chrome tanning. LIU (J), XU (Z), CHEN (Y), FAN (H), (National Engineering Laboratory

for Clean Technology of Leather Manufacture, Sichuan University, No. : 24 of Section 1 of South Yichuan, Yichuan Road, Chengdu 610065 of Sichuan Province, People's Republic of China). (J. Am. Leather Chem. Assoc.; 110, 2; 2015, Feb.; 43-53).

Diisocyanates qualify as tanning agent by virtue of their strong tendency to crosslink collagen molecules by reacting with amino groups. However, due to their sensitivity to water, these compounds cannot be used directly in aqueous environment, which is the basis for leather processing. Waterborne dimethylolpropionic acid-diisocyanate adducts(WDDAs) with temporarily-blocked isocyanate terminals were prepared to address this problem by using sodium hydrogen bisulfate($NaHSO_3$) as blocking agent and further evaluated as a pretanning agent for chrome tanning. Fourier transform infrared(FTIR) spectra revealed that the isocynate terminals in WDDAs were successfully blocked by $NaHSO_3$. The blocked isocyanates were stable under ambient temperature, but prone to deblocking under alkaline condition. The regenerated isocyanates were found still capable of crosslinking collagen molecules to impart hydrothermal stability. A high shrinkage temperature ($T_s$>110°Centigrade) was achieved in leather tanning by successfully treating goat skin with 5 wt% WDDAs and 4 wt% chrome powder. Stereomicroscope and scanning electron microscopy(SEM) observation further indicated that the WDDA-chrome tanned leather exhibited tight grain surface and well opened up fiber structure in comparison with semi-chrome tanned leather. WDDAs were found as enhanced the absorption of chromium in the resultant leathers (% chrome uptake>90%), resulting in significantly less chromium residual in the tanning wastewater due to the presence of carboxyl group in dimethylolpropionic acid. In addition, it is important to note that the usage of salt in pickling process was avoided owing to previous crosslinking of amino groups, which is very helpful for overcoming the problem of total dissolved solids(TDS) related to neutral salts. The tanning effect of WDDAs and their auxiliary function for chrome tanning allow them to be applicable as a pretanning agent, which efficiently alleviates the environmental impact of traditional chrome tanning for sustainability. (38 Ref.; 5 Tab.; 11 Fig.).

**TANNING MATERIALS**

**50.15329**

Divergent mechanistic routes for the formation of gem-Dimethyl groups in the biosynthesis of complex polyketides. POUST (S), PHELAN (RM), DENG (K), KATZ (L), PETZOLD (CJ), KEASLING (JD), (BioEnergy Institute, Lawrence Berkeley National Laboratory, 5885 Hollis Street, Enneryville, California 94608, USA). (Angew. Chem.; 54, 8; 2015, Feb., 16; 2370-3).

Describes the gem-dimethyl groups in polyketide-derived natural products that add steric bulk and accordingly**,** lend increased stability to medicinal compounds, however the authors' ability to rationally incorporate the functional group in modified natural products is limited. Indicated that the gem-dimethyl group producing polyketide synthase(PKS) modules of yersiniabactin and epithilne were characterized using mass spectrometry in order to characterize the mechanism of gem-dimethyl group formation, with a goal toward engineering of novel compounds containing this moiety. Demonstrates that methylation can precede condensation in gem-dimethyl group producing PKS modules in contrary to the caronical understanding of reaction order in PKSs. Experiments showed that both PKS are able to use dimethylmanonyl acyl carrier protein(ACP) as an extender unit. Interestingly, for epothilone module 8, use of dimethylmalonyl-ACP appeared to be the sole route to form a gem-dimethylated product, while the yersiniabactin PKS could methylate before or after ketosynthase condensation. (17 Ref.; 9 Fig.).

**FINISHING MATERIALS**

**50.15330**

Removal of Orange **II** dye from aqueous solution by adsorption and photodegradation with visible light in presence of nitrogen doped titania nanocatalyst. CHAKRABORTY (D), GUPTA (SS), (Department of

Chemistry, Bhola Nath College, Ward No. : 15, Dhubri, Assam-783 324, Assam State, India). (Indian J. Chem. Technol.; 22, 1-2; 2015, Jan.-Mar.; 34-41).

Investigated the possibility of treating water spiked with an azo dye, Orange **II** adsorption and photo-catalytic decolourisation with nitrogen doped $TiO_2$(titanium oxide). The prepared material has been characterized by XRD(X-ray diffraction), TEM(total transmission electronic microscope), BET(Brunauer-Emmett-Teller), DRS(Drag Reduction System) and XPS(X-Photoelectron spectroscopy) study. The photocatalytic reaction is carried out after the attainment of adsorption equilibrium between N-$TiO_2$(nitrogen-titaniumoxide) and dye. The batch process is chosen to adsorb the dye under different experimental conditions. The photoctalyst dose, initial dye-concentration and solution pH has been found to influence both the processes. The percentage decolourisation increases from 73.42% to 91.32% on increasing the N-$TiO_2$ dose 0.25 to 1.25 $gL^{-1}$. However, the further increase of the catalyst dose to 1.50 $gL^{-1}$ decreases the extent of decolourization(88.29%). The lower dye concentration favour decolourization(decreases from 84.24 to 75.43% for dye concentration of 18.0 to 36.0 $\mu molL^{-1}$. At *p*H 2.0, N-$TiO_2$ decolourises almost 84% of the dye within 240 minutes of irradiation time. Chemical Oxygen Demand(COD) results reveal ~91% mineralization of the dye on 360 minutes of irradiation. The percentage decolourisation of the dye is found to be high with N-$TiO_2$ compared to $TiO_2$ P25. The adsorption process follow the Lagergren first order model with the decolourisation process follow modified Langmuir-Hinshelwood model. (58 Ref.; 2 Tab.; 14 Fig.).

**50.15331**

Study on the removal of *m*-phenylenediamine from aqueous solution by adsorption over granular activated carbon. RAVAL (HD), RAVAL (AH), BHATT (JH), PANDYA (RP), (Materials Chemistry, Nanotechnology and Polymer Chemistry Division, Central Salt and Marine Chemicals Research Institute, Gijubhai Badheka Marg, Bhavnagar364 002, Gujarat State, India). (Indian J. Chem. Technol.; 22, 1-2; 2015, Jan.-Mar.; 42-7).

Describes *m*-Phenylenediamine(MPD) which is used for manufacture of thin film composite reveals reverse osmosis(RO) membrane in polymide thin film formation by interfacial polymerization. The used *m*-phenylenediamine solution has to be discarded as effluent. Granular activated carbon is found to be an efficient adsorbent for removal of *m*-phenylenediamine from aqueous solution. Branauer-Emmett-Teller(BET) surface area of the granular activated carbon is 446 $m^2/g$ and micropore volume 0.15 ee(enantioexcess)/g. A systematic study of adsorption of *m*-phenylenediamine over granular activated carbon with different loading of adsorbent in given *m*-phenylenediamine solution concentration and different concentration of *m*-phenyelenediamine solution in given adsorbent solution in given adsorbent quantity has been carried out. Describes the development of adsorption isotherms in each case. It is found that at 28% w/v concentration of adsorbent, the total MPD over granular activated carbon follows Freundlich isotherm x/m=k, where k=0.4576 and n=4. Moreover the study involves kinetics of adsorption of m=phenylenediamine over granular activated carbon at different temperatures and it is found that the kinetics of MPD adsorption over granular activated carbon follows Elovich model. The kinetic study indicates that the optimum temperature of adsorption is 40°X.

**50.15332**

Catalytic asymmetric hydrogenation of pyrimidines. KUWANO (R), HASHIGUCHI (Y), IKEDA (R), ISHIZUKA (K), (Department of Chemistry, Graduate School of Sciences and International Research Center for Molecular Systems(IRCMS), Kyushu University, 6-10-1 Hakozaki, Higashi-ku, Fukuoka 812-8581, Japan). (Angew. Chem.; 54, 8; 2015, Feb., 16; 2393-6).

Describes the asymmetric hydrogenation of pyrimidines proceeded with high enantioselectivity(up to 99% enantioexcess(ee) using an iridium catalyst composed of $[IrCl(cod)]_2$, a ferrocene-containing

chiral diphosphine ligand(Josip hos), iodine and $Yb(OTf)_3$(cod=1,5-cyclooctadiene). The chiral catalyst converted various 4-substituted pyridimines into chiral, 1,4,5,6-tetrahydropyrimidines in high yield. The lanthanide triflate is crucial for achieving the high enantioselectivity as well as for activating the heteroarene substrate. (51 Ref.; 2 Tab.; 1 Fig.; 2 Schemes).

**50.15333**

Highly enantioselective nickel-catalyzed intramolecular reductive cyclization of alkynones. FU (W), NIE (M), WANG (A), CAO (Z), TANG (W), (State Key Laboratory of Bio-organic and Natural Products Chemistry, Shanghai Institute of Organic Chemistry, Chinese Academy of Sciences(CAS), No. : 345 Ling Ling Road, Shanghai 20032, China). (Angew. Chem.; 54, 8; 2015, Feb., 16; 2520-4).

Reports the first asymmetric nickel-catalyzed intramolecular reductive cyclization of alkynones. AP-chiral monophosphine and triethylsilane were used as the ligand and the reducing reagent, respectively, to form a series of tertiary allic alcohols bearing furan/pyran rings in excellent yields and enantioselectivities. This reaction has a broad substrate scope and enabled the sufficient synthesis of dehydroxycubebin and chiral dibenzocyclooctadiene skeletons. (81 Ref.; 2 Tab.; 4 Fig.; 2 Schemes).

**50.15334**

Alternating copolymerization of propylene oxide with biorenewable terpene-based cyclic anhydrides : A sustainable route to aliphatic polyesters with high glass transition temperatures. Van ZEE (NJ), COATES (GW). (Department of Chemistry and Chemical Biology, Baker University, Cornell University, Ithaca, New York 14853-1301, USA). (Angew. Chem.; 54, 9; 2015, Feb., 23; 2665-8).

Reports the alternating copolymerization of propylene oxide with terpene-based cyclic anhydrides catalyzed by chromium**,** cobalt and aluminium salen complexes. The Diels-Alder adduct of á-terpinene and maleic anhydride as the cyclic anhydride comonomer results in amorphous polyesters that exhibit glass conditions and choice of catalyst have a dramatic impact on the molecular weight distribution, the relative stereochemistry of the diester units along the polymer chain and ultimately the Tg(6-thioguanine) of the resulting polymer. The aluminium salen complex exhibits exceptional selectivity for copolymerization without transesterification or epimerization side reactions. The resulting polyesters are highly alternating and have high molecular weights and narrow polydispersities. (47 Ref.; 2 Tab.; 1 Fig.; 2 Schemes).

**50.15335**

Hardness, tribology and microstructural studies on aluminium-flyash metal matrix composites. KUMAR (KAR), BALAMURUGAN (K), GNANARAJ (D), (Mechanical Engineering Department, Institute of Road & Transport Technology, Near Vasavi College, Chithode, Erode-638 316, Erode District, Tamil Nadu State, India). (J. Sci. Ind. Res.; 74, 3; 2015, Mar.; 165-70).

Describes the synthesis of the flyash reinforced aluminium metal matrix composites(Al-MMC) by stir resting method and was fabricated by sand coating into required sizes. Flyash content with various compositions(9, 14 and 19 wt%) was used with aluminium metal by adding magnesium content 1% for the present investigations. Tested the flyash content with various compositions of Al-MMCs use for its hardness using Vicker's microhardness tester. It was found that the hardness increases with increase in flyash content. Investigated the surface morphology of the samples by scanning electron microscope(SEM) and optical microscopic techniques(OMTs). Tribological proportion such as coefficient of friction and wear rate for various flyash compositions were obtained and the results were discussed in detail.

**50.15336**

Efficient coupling of solar energy to catalytic hydrogenation by using well-designed palladium nanostructures. LONG (R), RAO (Z), MAO (K), LI (Y), ZHANG (C), LIU (Q), WANG (C), LI (Z), WU (X), XIONG (Y), (Hefei National Laboratory for Physical Sciences at the Microscale, Collaborative Innovation Center of Chemistry for Energy Materials, School of Chemistry and Materials Science and Academy of Sciences(CAS) Key Laboratory of Materials for Energy Conversion, University of Science and Technology of China, No. : 96, JinZhai Road, Baohe District, Hefei 230026, Anhui Province, People's Republic of China). (Angew. Chem.; 54, 8; 2015, Feb., 16; 2425-30).

Describes a $Ru3^{+}$-mediated synthesis for the unique Pd(palladium) concave nanostructures, which can directly harvest ultraviolet(UV)-to-visible light for stegreve hydrogenation. The catalytic efficiency under 100 mW $cm^{-2}$ full-spectrum irradiation at room temperature turns out to be comparable to that of thermally(70°Centigrade) driven reactions. The yields obtained with other Pd nanocrystals, such as nanocubes and octahedrons, are lower. The nanostructures reported here have sufficient plasmonic cross-sections for light harvesting in a broad spectral range owing to the reduced shape symmetry, which increases the solution temperature for the reaction by the photothermal effect. They possess a large quantity of atoms at corners and edges where local heat is more efficiently generated, thus providing active sites for the reaction. Taken together, these factors drastically enhance the hydrogenation reaction by light illumination. (38 Ref.; 13 Fig.).

**50.15337**

Total synthesis of (±)-Hippolachtin A. RUIDER (SA), SANDMEIER (T), CARREIRA (EM), (Laboratorium für Organische Chemie, ETH Zurich, HCl H335, Vladimia-Prelog-Weg 3, 8093 Zürich, Switzerland). (Angew. Chem.; 54, 8; 2015, Feb., 16; 2378-82).

Describes the first total synthesis of the marine polyketide(±)-hippolachmin A that has been achieved in nine linear steps and an overall yield of 9%. Rapid access to the oxacyclobutapentalene core structure was secured by strategic application of an ene cyclization. (67 Ref.; 1 Tab.; 2 Fig.; 4 Schemes).

**BY-PRODUCTS**

**50.15338**

Effect of excess on polycyclic aromatic hydrocarbons removal from petroleum sludge using thermal treatment with additives. PAKPAHAN (EN), ISA (MH), KUTTY (SRM), CHANTARA (S), WIRIYA (W), FAROOGI (IH), (Civil Engineering Department, Universiti Teknologi, PETRONAS, Perak, Malaysia). (J. Sci. Ind. Res.; 74, 3; 2015, Mar.; 245-9).

Describes the petroleum sludge that contains polycyclic aromatic hydrocarbons (PAHs) which are hazardous compounds due to their toxic and carcinogenic-mutagenic characteristics. The United States Environmental Protection Agency(USEPA) has identified 16 of these compounds as priority pollutants. The study evaluates the effectiveness of excess air addition in thermal removal of priority PAH from petroleum sludge treated in a rotary-drum electric heater at 650°Centigrade with $Ca(OH_2)$(calcium hydroxide)(1mol) + $NaHCO_3$(sodium bicarbonate) (1 mol)(1:1) additives. The concentrations of PAH in flue gas and residue phase were determined using Gas Chromatography-Mass Spectrometry(GC-MS). The samples were extracted with acetonitrile by ultra-sonication prior to GC-MS analysis. The concentrations of 2-3 ring PAH, 4-6 ring PAH, suspect carcinogenic PAH, ©PAH and ©tEF(Test d'Evaluation) were determined. Excess air addition was found to be instrumental in PAH removal.

**TANNERY. ENVIRONMENTAL ASPECTS**

**50.15339**

Oil/water separation with selective superantiwetting/superwetting surface materials. CHU (Z), FENG (Y), SEEGER (S), (Department of Chemistry, University of Zurich, Winterthurerstrasse 190, Zurich CH-8057, Switzerland). (Angew. Chem.; 54, 8; 2015, Feb., 16; 2328-38).

Describes the separation of oil from oily water as an important pursuit because of increasing worldwide oil pollution. Separation by the use of materials with selective oil**/**water absorption is a relatively recent area of development, yet highly promising. Discusses the superhydrophobic/superoleophilic surfaces and underwater superoleophobic surfaces that have been developed for the separation of oil/water-free mixtures and emulsions owing to their selective superantiwetting/superwetting properties towards water and oil. Describes also the principles of materials with selective oil/water absorption and outline recent advances in oil/water separation with superwetting/superantiwetting materials including their design, their fabrication and models of experimental setups after a short introduction to oil/water separation. Finally, discusses also about the current state of this new field and point out the remaining problems and future challenges. (72 Ref.; 30 Fig.).

**50.15340**

Assessment of groundwater quality in the Mining Areas of Goa, India. GURDEEP SINGH, KAMAL (RK), (Center for Mining Environment, Department of Environmental Science and Engineering, Indian School of Mines, Sardar Patel Nagar, Dhanbad-826 004, Jharkhand Sate, India). (Indian J. Sci. Technol.; 8, 6; 2015, Mar.; 588-95).

Goa is a famous international tourist destination and attracts around 2 million tourists annually. Tourism is generally limited along the coastal belt of Goa, while mining is more focused in the midland of Goa. The groundwater in the State is mainly used for drinking and industrial purposes followed by agriculture to some extent. The open cast iron ore mining in Goa had induced significant changes in groundwater quality and quantity. Aims for the assessment of the impact of mining activities on the qualitative scenario of groundwater in the study area. The monitoring of groundwater quality was done at forty five groundwater sampling locations on a seasonal basis(i.e. post-monsoon, winter, summer and monsoon) from October 2011 to September 2012. Ground water quality status was assessed by using the Water Quality Index(WQI) method, which is an effective tool to assess spatial and temporal changes in ground water quality. Based on the descriptive categories of WQI values observed, all(100%) the sampling locations in the study area observed with very good category. (25 Ref.; 3 Tab.; 1 Fig.).

**50.15341**

Contribution of sewage treatment to pollution abatement of carbon streams. JAMWAL (P), ZUHAIL (TM), URS (PR), SRINIVASAN (V), LELE (S), (Center for Environment and Development, Ashoka Trust for Research in Ecology and the Environment(ATREE), Royal Enclave Srirampura, Jakkur, Bengaluru-560 064, Karnataka State, India). (Indian J. Environ. Hlth.; 105, 4; 2015, Feb., 25; 677-85).

Assessed the efficiency and effectiveness of the Vrishabhavathy Valley Treatment Plant(VVIP) in Bengaluru city, which is the oldest sewage treatment plant(STP) in the city. Since VVTP treats both raw sewage and polluted river water, with the latter constituting 80% of the influent, water quality at locations upstreams and downstream of the plant to evaluate overall efficacy as well. It is found that VVTP is able to reduce biochemical oxygen demand(BODs) by only 47%. This low efficiency can be attributed to the high and variable levels of chemical oxygen demand(COD), consistent with episodic industrial discharges.

Moreover, the mean value of *p*H, dissolved oxygen, total dissolved solids(TDS), BODs, nitrates, facial coliforms and *faecal streptococcus* and not change significantly between upstream and downstream locations. It is stated that treating water using an STP is clearly not an efficacious way of improving river water quality. Thus, before setting up new STPs, sewerage boards need to invest in building the underground drainage network to bring raw sewage to existing STPs. (22 Ref.; 2 Tab.; 7 Fig.).

**50.15342**

Nitrospurines En route to potently cytotoxic asmarines. WAN (KK), IWASAKI (K), UMOTOY (JC), WOWAN (DW), SHENVI (RA), (Department of Molecular and Experimental Medicine and Chemical Physiology, The Scripps Research Institute, 10550 N.Torrey Pines Road, La Jolla, California 92037, USA). (Angew. Chem.; 54, 8; 2015, Feb., 16; 2410-5).

Describes a nitrosopurine ene reaction that easily assembles the asmarine pharmacopore and transmits remote stereochemistry to the diazepine-purine heterocycle. This reaction generates potent cytotoxins which exceed the potency of asmarine A(1-2 MIC50) and supersede the metabolites as useful leads for biological discovery. (34 Ref.; 1 Tab.; 8 Fig.; 1 Scheme).

**50.15343**

Spectrophotometric determination of chromium by using sulphanilic acid and N,N-dimethylaniline. CHANDRASHEKHARA (KG), GOPALAKRISHNA (BN), NAGARAJ (P), (Department of Chemistry, Srinivas Institute of Technology(SIT), Farangipet, National Highway 48, Valachil Arkula, Merlapadavu, Mangaluru 574 143, Karnataka State, India). (Indian J. Chem. Technol.; 22, 1; 2015**,** Jan.-Mar**.;** 78-81).

Describes the development of a sensitive and selective spectrophotometric method to determine the trace amounts of chromium**(VI)** with bromine water. Chromium**(VI)** oxidises hydroxylamine using acetate buffer of *p*H 4 to nitrile, which then diazotizes sulphanilic acid to form diazonium salt. These diazonium salts are then coupled with N,N-diamethylaniline in alkaline medium resulting azo dye methylorange, which induces orange color in acidic medium shows an adsorption maximum at 507 nm. The method is free from the interferences of several metal ions and obeys Beer's law in the range of 0.1 to 0.8 g/mL in acidic medium. Molar absorptivity and Sandell's sensitivity of the system with sulphanilic acid diazoniumchloride and N,N'-dimethylaniline couple(methyl orange) in acidic medium are found to be $1.74x10^{4}Lmol^{-1}cm^{-1}$ and $3.84x10^{-3}ìg/cm^{2}$ respectively. Describes also the optimum reaction condition evaluation and interference of other ions on the determination. The method is useful for the analysis of chromium in soil and pharmaceutical samples. (17 Ref.; 3 Tab.; 2 Schemes).

**50.15344**

Scalable template synrhesis of Resoscinol-Formaldehyde/Graphene oxide composite aerogels with tenable densities and mechanical properties. WANG (X), LU (L), YU (Z), XU (X), ZHENG (Y), YU (S), (Division of Nanomaterials & Chemistry, Hefei National Laboratory for Physical Sciences at Microscab, Collaborative Innovation Center of Suzhou NanoScience and Technology, Chinese Academy of Sciences(CAS) Key Laboratory of Mechanical behavior and Design of Materials, Department of Chemistry, University of Science and Technology of China, No. : 96, JinZhai Road, Bache District, Hefei 230026, Anhui Province, People's Republic of China). (Angew. Chem.; 54, 8; 2015, Feb., 16; 2397-401).
Describes the Resorcinol-formaldehyde(RF) and graphene oxide(GO) aerogels that have found a variety of applications owing to their excellent properties and remarkable flexibility. However, the macroscopic and controllable synthesis of their composite gels is still a great challenge. Discusses the development of the first low-temperature scalable strategy for the synthesis of a new kind of RF-GO composite gel with tunable densities and mechanical properties by using GO sheets as template skeletons and

metal ions($Co2^{+}$, $Ni2^{+}$ or $Ca2^{+}$) (cobalt ion, nickel or calcium) as catalysts and linkers. The aerogels can tolerate a strain as high as 80% and quickly recover their original morphology after the compression has been released. The gels might find applications in various areas, for example, as adsorbents for the removal of dye pollutants and in oil-spill cleanup owing to their compressibility. (40 Ref.; 10 Fig.; 1 Scheme).

**50.15345**

Synthesis and application of formaldehyde free melamine glutaraldehyde amino resin as an effective retanning agent. SALEEN (R), ADNAN (A), QURESHI **(**FA)**,** (Office of Research Innovation and Commercialization, Comsats Institute of Information Technology, Chakshahzad Campus, Park Road, Islamabad 45600, Pakistan). (Indian J. Chem. Technol.; 22, 1-2; 2015, Jan.-Mar.; 48-55).

Describes the synthesis of the novel melamine based free formaldehyde as a condensing agent rather than formaldehyde under optimum conditions for use as a retanning agent. Investigated the characteristics and effects of the polymer as a retanning agent against conventional melamine formaldehyde resin. Studied the tear strength, tensile strength, elongation at break and scanning electron microscopy(SEM) of experimental retanned leather in comparison with commercial melamine formaldehyde retanned leather and are found to be in better performance. Evaluated the effluent emission of both retanning baths and found to contain less effluent load in experimental bath, thus less impact on the environment. Glutaraldehyde alone affects dyeing process and produces in levelling of shade. Indicates here about the improvement of the dispersing and leveled dying property of glutaraldehyde after condensing with melamine. Both experimental and conventional melamine resins have shown good dispersing and leveling property in dying process of a tanned leather. Structural elucidation of the experimental resin have been carried out by Fourier Transform Infrared Resonance (FTIR) technique. (30 Ref.; 3 Tab.; 7 Fig.).

**LEATHER PRODUCTS**

**FOOTWEAR**

**50.15346**

Exporting footwear to Europe-Part **III**. ACHARYA (DK), (M**/**s. Council of Leather Exports(CLE), Western Region, STAR HUB, Building 1, Unit No. : 102, 1st Floor, Near Hotel Hyatt Regency & ITC Maratha Sahar International Airport Road, Andheri(West), Mumbai-400 099, India). (Leather News India; 6, 12; 2015, Dec.; 81-4).

Discusses the importance of fashion footwear and strategy required to capture this market segment in Europe. (2 Tab.; 15 Photos).

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