ILTA
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# JILTA

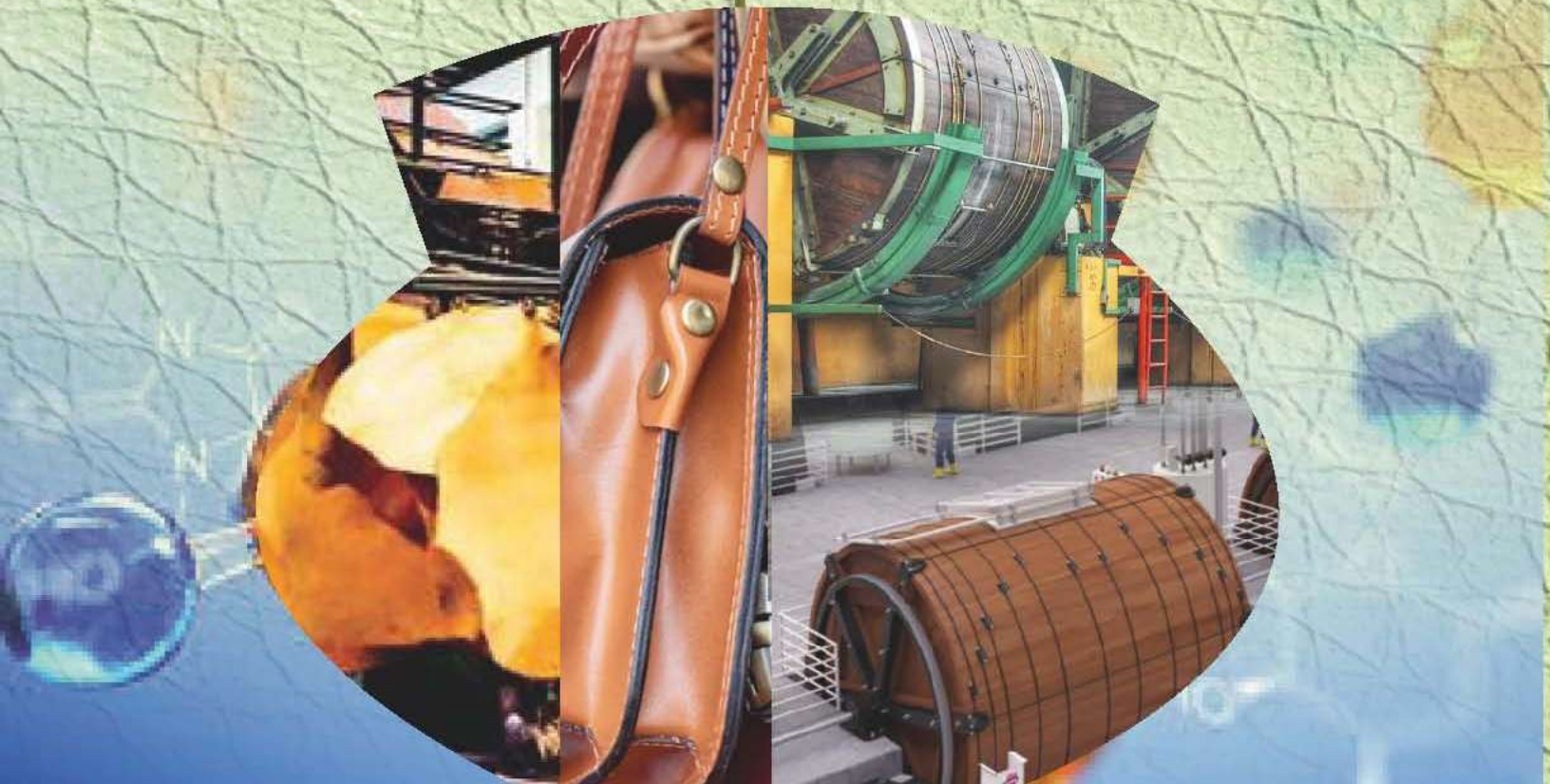
Journal of Indian Leather Technologists' Association

JILTA 2022 2023

VOLUME : LXXIII NO :09 SEPTEMBER, 2022

Rgtn. No. KOL RMS/074/2022-24
Regd. No. ISSN 0019-5738
RNI No. 2839/57
Date of Publication: 6th

₹50.00



# Our Activities

- An Association with over 600 members from India and abroad working since last 68 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.
- Assist small and tiny leather goods manufacturers in marketing their products by organizing LEXPOs in Kolkata and different parts of India.



**Indian Leather Technologists' Association**

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

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JOURNAL OF INDIAN LEATHER TECHNOLOGISTS' ASSOCIATION (JILTA)

SEPTEMBER, 2022 VOL.: LXXIII NO.: 09 RNI NO.: 2839/57 REGD.NO.: ISSN 0019-5738

## Contents



**Hony. Editor :** Dr. Goutam Mukherjee

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**Cover Designed & Printed by :**

M/s TAS Associate

11, Priya Nath Dey Lane, Kolkata - 700 036

**Published & Printed by :**

S. D. Set, on behalf of Indian Leather Technologists' Association

**Published from :**

Regd. Office : 'Sanjoy Bhavan', 3rd Floor,

44, Shanti Pally, Kasba, Kolkata - 700 107

**Printed at :**

M/s TAS Associate

11, Priya Nath Dey Lane, Kolkata - 700 036

**Subscription :**

| | | |
|---|---|---|
| Annual | Rs.(INR) | 400.00 |
| Foreign | $ (USD) | 45.00 |
| Single Copy | Rs.(INR) | 50.00 |
| Foreign | $ (USD) | 4.00 |

**All other business communications should be sent to :**

Indian Leather Technologists' Association

'Sanjoy Bhavan', 3rd floor, 44, Shanti Pally

Kasba, Kolkata - 700 107, WB, India

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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).

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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| 3rd Cover | Rs. 84,000/- |
| Back Cover | Rs. 1,20,000/- |

**Mechanical Specification**

| | | |
|---|---|---|
| Overall size | : | 27 cm X 21 cm |
| Print area | : | 25 cm X17 cm |

Payment should be made by A/c. Payee Cheque to be drawn in favour of :

**Indian Leather Technologists' Association**
and Payable at **Kolkata**

*Send your enquiries to* :

**Indian Leather Technologists' Association**
'SANJOY BHAVAN'
3rd floor, 44, Shanti Pally, Kasba, Kolkata – 700 107
Phone : 91-33-24413429 / 91-33-24413459
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(Member Society of International Union of Leather Technologists and Chemists Societies)

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# INDIAN LEATHER TECHNOLOGISTS' ASSOCIATION (ILTA)

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

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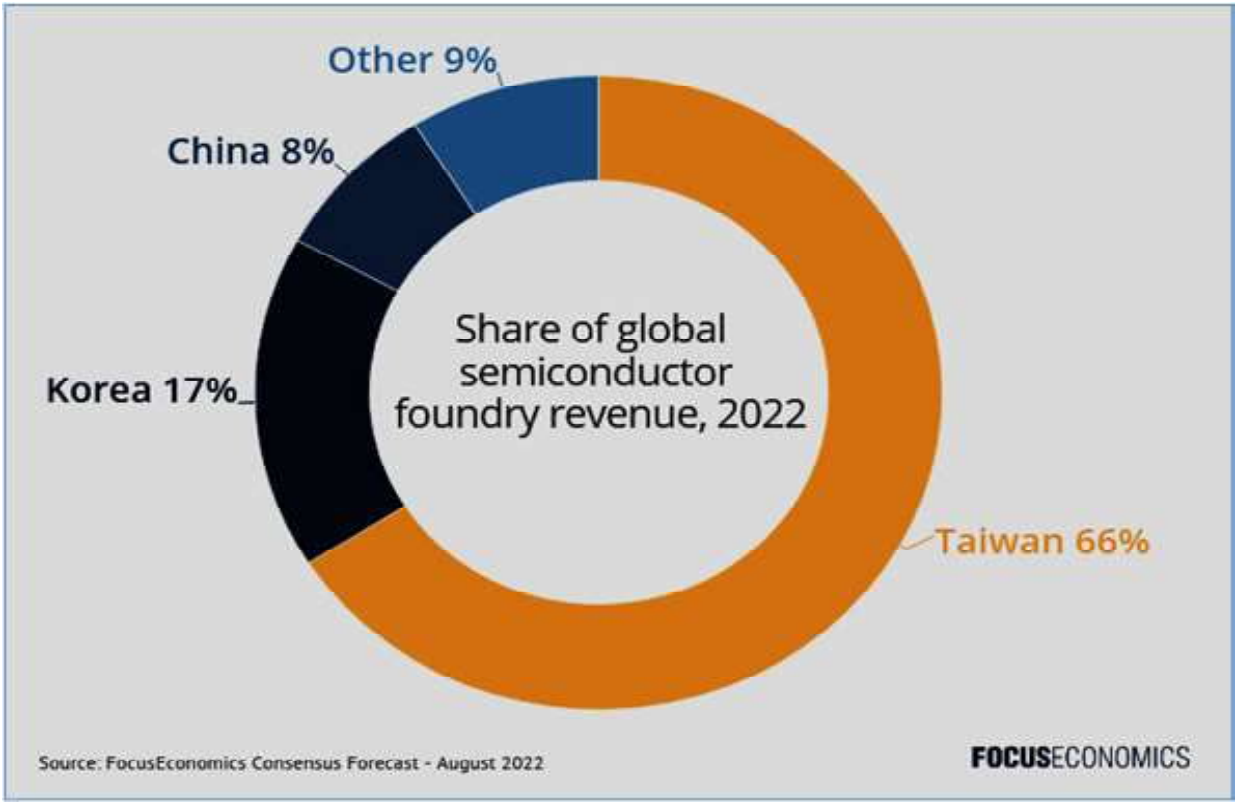
# JOURNAL OF INDIAN LEATHER TECHNOLOGISTS' ASSOCIATION (JILTA)


Leather Fraternity 72 years of service to the International

# US - China Locking Horns Over Taiwan

China launched a series of military drills close to Taiwan, in response to Nancy Pelosi—the Speaker of the U.S. Congress—visiting the country in July. In response, in mid-August the U.S. sent a fresh delegation to Taiwan and announced it would soon begin formal trade talks with the island. For now, the global economic impact should be negligible, barring a likely slight hit to Taiwan's growth prospects due to weaker business sentiment and some disruption to trade. The bigger danger lies in the longer term, as U.S.-Taiwan ties are set to deepen over the next few years. By antagonizing China, these will likely lead to further military drills and economic retaliation from Beijing against Taiwan—and potentially against the U.S. too.




In such a scenario, some firms would re-rout investment from Taiwan to other parts of Asia to minimize geopolitical risk. Moreover, frequent Chinese military drills around Taiwan could delay global shipping and raise transport costs: Almost half of the global container fleet has passed through the Taiwan Strait so far this year according to Bloomberg data. In particular, any delays to shipments of semiconductors—an industry in which Taiwan is the world's dominant player—would hit world production of a host of goods, from smartphones to SUVs. Additionally, a further deterioration of U.S.-China relations due to Taiwan would hurt trade between the two superpowers and further accelerate the decoupling of supply chains, damaging global growth. Of course, by far the worst outcome for the global economy would be a Chinese invasion of Taiwan. This would set the stage for a series of tit-for-tat sanctions between China and the West, likely pummel semiconductor supply and risk morphing into a global conflict of untold economic proportions.

**Ma Tieying**, economist at **DBS Bank**, said :

"The world's major economies will likely continue to push for semiconductor investment in their home markets, to prevent the risk of chip supply shortage from Taiwan. The US successfully lobbied TSMC to build a 5nm chip factory in Arizona in 2020. Japan also convinced TSMC to construct a fabrication plant in Kumamoto last year. More recently, the US Congress passed the CHIPS and Science Act in July, providing USD52.7bn funds for the American semiconductor R&D, manufacturing and workforce development. […] A global race for semiconductor investment could induce additional chip production costs and aggravate the risk of overcapacity in the longer term."

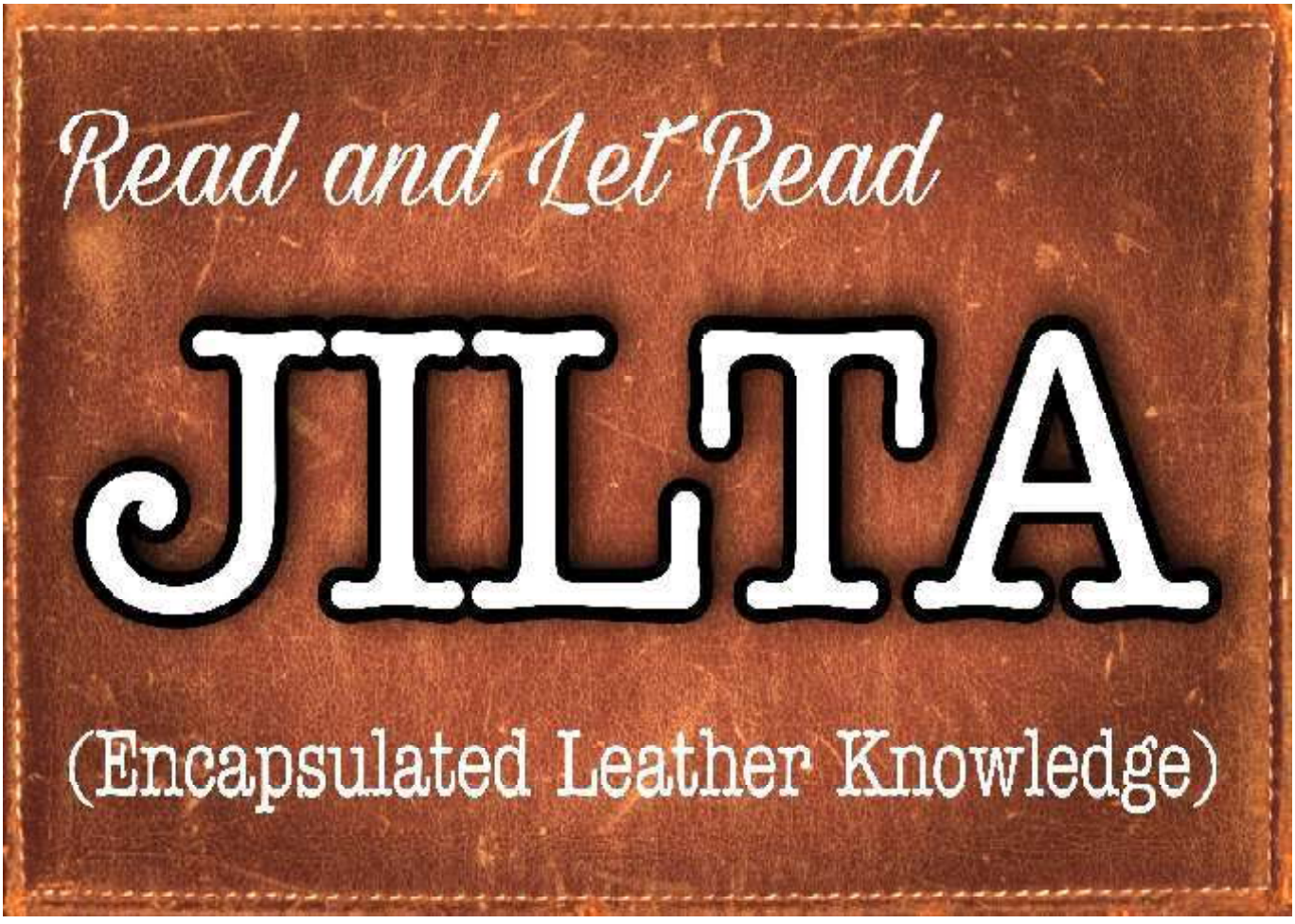
**Analysts** at **the EIU** commented :

"A future flash point will be negotiations around formal US Taiwan trade talks. Although these developments are only rumours at this point, the initiation of formal trade negotiations (which may go beyond the scope of US Taiwan trade and investment talks in June) would probably prompt a strong Chinese response, in ways that could exacerbate the risks and uncertainty currently facing cross Strait supply chains."

Such kind of endangerment of the already troubled world should be stopped for the interest of human race.

Goutam Mukherjee

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




As an active proponent of responsible chemistry, Stahl has established the Stahl Campus® training institute in its Center of Excellence for sustainable leather technologies in Kanpur. With our Stahl Campus® Leather Modules, we can offer training and information, such as responsible chemistry and sustainability in leather production. We believe that in this way, we facilitate transparency that inevitably will lead to a better supply chain with responsible chemistry.

Our approach is modular, making it easy to tailor learning programs to specific needs. Stahl Campus® has at its core the drive to unlock human potential and make that new competitive advantage. By providing the possibility of sharing knowledge, we embrace our role in the dynamic leather and chemical industry. Stahl Campus® is a great opportunity to strengthen skills and capabilities in order to make working methods more efficient by sharing experiences and studying products and procedures.

If you're interested to receive more information on Stahl Campus®, please contact Prasanna Maduri **(Prasanna.maduri@stahl.com)**.

If it can be imagined, it can be created.

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Seize the opportunities
of renewable chemistry
Stahl
Impact

# SHIFTING TOWARDS A CIRCULAR ECONOMY IS THE NEXT STEP IN THE INDUSTRIAL REVOLUTION

On the Earth Overshoot Day. Our earth is exhausted. Today we take more from nature's resources than our planet can provide. Clearly, that fact alone means we have to stop using finite resources and look for ways to reduce the environmental footprint of the leather industry. Therefore, it is important to focus on redesigning our products and processes by using responsible chemistry and resourcing. In this article, I share my thoughts on what I see as the unavoidable transition to a circular economy, and what companies can do to contribute to a better planet.

As a Green Technology Chemist at Stahl, I spend my time thinking about how we can redesign products and processes so they align with the circular way of thinking. How we can make smarter and better use of raw and semi-finished materials, reducing our impact in the value chain, while supporting our customers with possible solutions with regards to prolonged usage, reuse, refurbish and recycling of their products.

Sustainability is a broad topic, but the keywords that recur in my work include things like "bio-based materials", "closed loop materials", "circular economy", "emission reduction" and the replacement of toxic chemicals and processes.

**New models, technologies and cooperation**

For a long time, we believed that raw material supplies were limitless. Now it is clear that they are not, and that we must make the transition to a circular economy. But how? How can we make the switch?

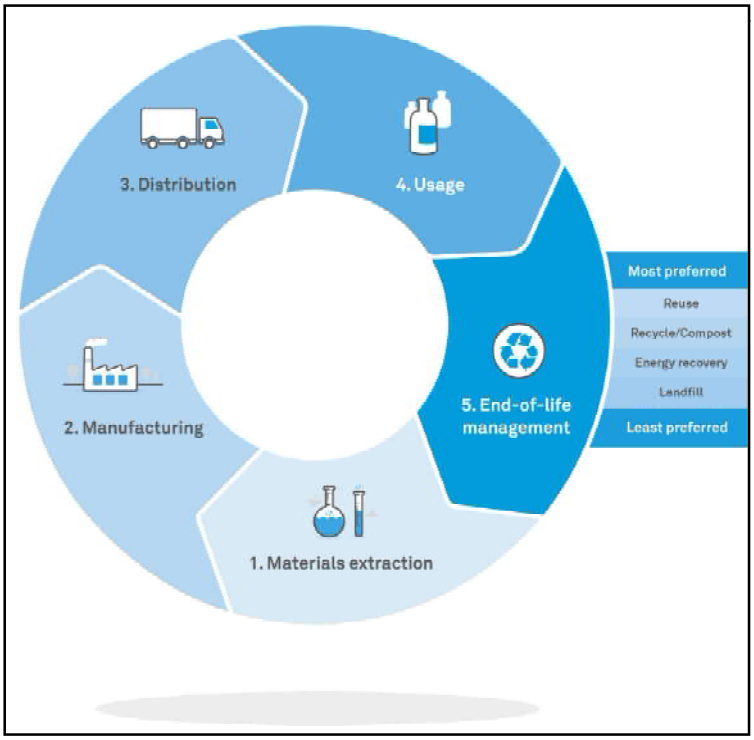
The key thing to understand is that the move to a circular economy not only requires new business and market models, it also requires changes to the value system and technological innovation. It involves cooperating, evaluating and re-evaluating to steer the economy in the right direction. Designing for the circular economy is an all-new process and sometimes you have to step outside your comfort zone to be able to develop circular products and processes. You have to take your time to do research and explore. And to quote Amy Edmondson: "We've got to be willing to fail - smart failures are needed to learn things and to learn them fast."

This is certainly something we have found to be true at Stahl. We know we cannot change the world by ourselves and that we need to take one step at a time. That's not defeatist, it's realistic, because it enables us to build trust and develop a solid foundation on which to talk about and move forward on greener technologies with our customers and partners.

**One step at a time**

The nature of a circular economy makes trust and collaboration crucial. This is because each part of the value chain is connected. We can only solve the overall problem if we understand the individual challenges. flThe idea is to retain as much of their value as possible and so reduce, and if possible exclude, the need for virgin materials. This means looking at the whole lifecycle of a product, from raw material sourcing through its use to the disposal of the end product after usage, to determine where we can minimize the amount of virgin materials involved and how we can we limit the environmental, economic and social impact. I often use the diagram below to explain the process.

Within the circular economy, our challenge is to explore and identify where in the lifecycle we can reduce the impact of a product. The complexity of a circular economy, in which everything is connected, makes it inevitable that you can only take one step at a time. The driver is to focus on what you can do and should do rather than of what you can't.




This is exactly what we do at Stahl, and I would like to use this to illustrate the improvement opportunities I see and explain a few of the steps we have taken towards a circular economy.

**Closing the loop in a world of complex products**

In a perfect circular world, we could simply de-atomise our products and reuse all our materials, with no new virgin materials required. Unfortunately, the real world is more complex. To be specific, products are more complex.

Combining different materials has delivered our current standard of living, but it also makes changing to a circular economy more challenging. Re-evaluating materials and their use is going to be key in making the transition to a circular economy. For simple products made from one type of material – such as glass, paper, textiles, metal or plastics – recycling, including chemical recycling, and biological recycling (composting) will be key. For complex products, end of life management is more challenging, and will requiring more extensive research. Switching to more sustainable raw materials is a good starting point, while working on end-of-life solutions.

This is also the case for most of Stahl's products. The wide range of customer applications and the complexity of for example a (polyurethane) coating, makes it difficult to find a one-fits -all solution to close the loop. Using biomass or carbon dioxide as the source of our materials is a start, reducing the impact of our products at the end of their lives. It of course does not stop there and we need to find individual end-of-life solutions for each application.

**Renewable raw materials enhance our chemical toolbox**

It is important to emphasize that sustainable developments are not incremental innovations. The transition to fully renewable materials is a path that requires new technologies, collaboration and compromises. We see this as an area in which Stahl can have a significant positive impact. As facilitators of renewable feedstock solutions, we can help society decouple growth from fossil carbon-based resource consumption and support de-fossilization.

We are introducing dedicated product lines that offer a more sustainable choice to conventional market alternatives without compromising on functional performance. This approach includes improving the sustainability profile of our product portfolio by incorporating more recycled and bio-based feedstocks upstream. We also design solutions to have a lower downstream environmental impact than conventional products, for example by minimizing water consumption and ensuring higher water quality.

The novel properties of these renewable materials will add new tools to our chemical toolbox and make it possible to solve problems we experience now. We are in a transition phase in which, from a technical and chemical point of view, the opportunities are endless.

**Collaboration is the key to a successful transition**

At Stahl, we believe in the long-term potential of renewable feedstock chemistry. We want to be the driving force behind this industry-wide transformation – by not only helping our customers meet growing consumer demand for products that help to protect the environment but also driving awareness and sharing important technical know-how on developing solutions.

Collaboration is the cornerstone of our efforts to drive renewable feedstock chemistry forward. By working with like-minded partners across industries and advocating for the wider adoption of renewable chemistry solutions, we can multiply the positive impact of our science and innovation for the benefit of society at large.

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**Shift towards even more sustainable materials**

We are also supporting the development of alternative, sustainable materials, such as materials made from mushrooms, fruit and jellyfish, plus other organic, natural ingredients. These are all sustainable materials whose properties we can improve. Make them more durable, for example, or give them the specific aesthetics a brand or certain consumers value in a product. It is a great example of how working together within our supply chain contributes to a better planet!

**Find the world at your feet**

As Stahl, we are convinced that the best way for our industry to achieve a sustainable future is via transparency and cooperation in the supply chain. I am proud that this way of thinking is embedded in our daily business, and that we are working on new ways to contribute to the environment by collaborating with industry peers and universities, taking one-step at a time.

The transition to the circular economy will not be easy, but I have faith that we will succeed. Personally, as a scientist, I love being part of this and expanding our knowledge bit by bit. I find it fulfilling to contribute to a better planet for the current and future generations. Leading your company towards a more sustainable and responsible future might feel like stepping into uncharted territory, but as we are finding, we believe that those who venture out into the great unknown are those who will find the world at their feet.

*(Stahl News – 28/07/2022)*

## STAHL JOINS CLIB BIOTECHNOLOGY NETWORK TO REINFORCE OPEN INNOVATION, RESPONSIBLE CHEMISTRY COMMITMENTS

Stahl, an active proponent of responsible chemistry, has joined CLIB, an international open innovation cluster of stakeholders in the biotechnology space. CLIB is committed to providing networking opportunities for its members across different industries and sectors with a view to using biotechnology to foster sustainability. Stahl's membership of the network underlines the company's commitment toflopen innovation and to working with partners across value chains to reduce its Scope 3 emissions.

CLIB members include large companies, SMEs, start-ups, academic institutes, universities, and other stakeholders engaged in biotechnology and the circular- and bioeconomy as a whole. As part of this cluster, Stahl seeks to connect with likeminded contacts and partners to explore opportunities for increasing the use of bio-based and bio-derived solutions in its chemistries, products, and applications. In turn, Stahl hopes to add value to other members of the network by providing a route to market for biotechnology solutions through the company's extensive range of industrial products and applications.

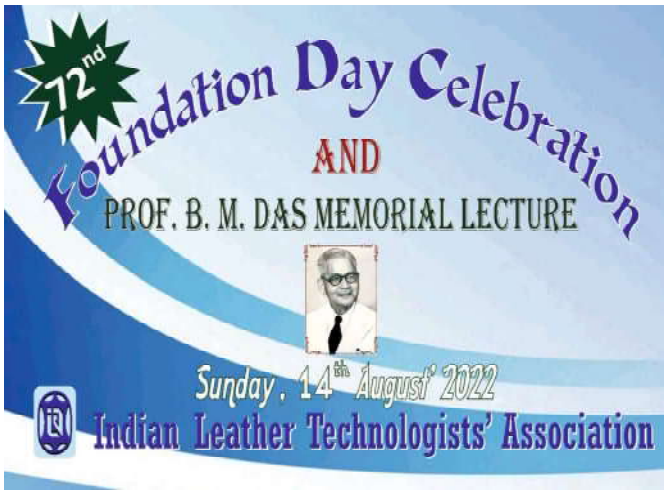
Stahl's first face-to-face interaction with its fellow CLIB members will take place at the CLIB Networking Day in October 2022.

Tim Kidd, Senior Open Innovation Account Manager at Stahl:"Joining CLIB is a great opportunity for Stahl to innovate alongside external partners in the biotechnology space, who share our commitment to sustainability and the circular economy. Our membership reinforces our focus on open innovation, a key strategic pillar at Stahl, and on building mutually beneficial partnerships with the value chain. Working with adjacent technologies in this way provides a strong platform to explore and develop responsible solutions that will expand our innovation toolbox and allow us to meet our Scope 3 commitments and wider environmental ambitions."

*(Stahl News – 01/08/2022)*

# *From the desk of* General Secretary

## 72ND FOUNDATION DAY CELEBRATION & PROF. B. M. DAS MEMORIAL LECTURE




The Foundation Day Celebration of our association was organized at the Seminar Hall, Science City, JBS Haldane Avenue, Kolkata – 700 046 on Sunday the 14th August, 2022 at 03.00 PM onwards.

After the Welcome Address Mr. Mallick invited the Speaker of the day, Senior Members of ILTA, Representatives of GCELT, Alumni of GCELT, CLRI, CFTC, FDDI, ILPA and from Industry for garlanding the portrait of Prof. B. M. Das.

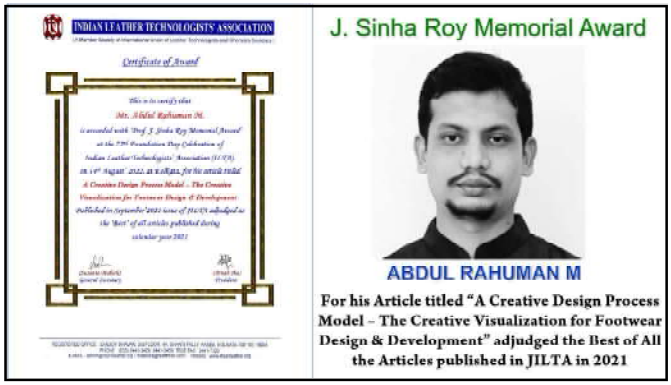
The program commenced with the introductory speech by Mr. Susanta Mallick, General Secretary, ILTA followed by Welcome Address by the President of ILTA Mr. Arnab Jha.

Thereafter Mr. Mallick announced the names of the award winners and informed that the respective awards would be sent to them through courier.

a) **Ms. Ayugma Sengupta** – Winner of both B. M. Das Memorial Medal & J. M. Dey Memorial Medal for securing 1st Class 1st Position in B. Tech, Leather Technology Examination of Moulana Abul Kalam Azad University of Technology, West Bengal in 2022.


b) Due to some unavoidable circumstances, result of B.Tech, Leather Technology Examination & M. Tech, Footwear Science & Engineering Examination of Anna University, Chennai for the year 2022 could not be published in time and as per information from Anna University, it will get delayed. So ILTA will send Medals, & Certificates of toppers in 2022 later by courier, once the names are available from Anna University.

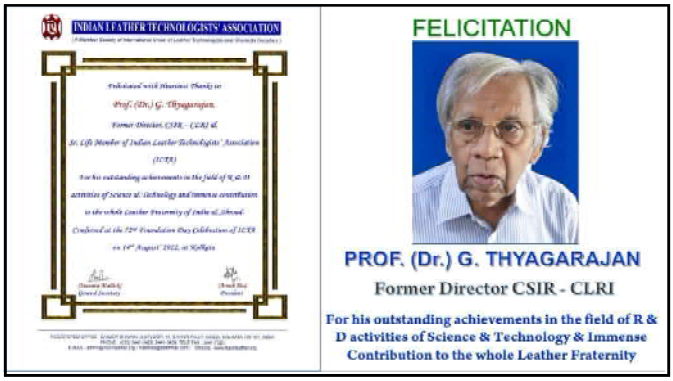
c) **Mr. Abdul Rahuman M** – Winner of J. Sinha Roy Memorial Award for his article titled "**A Creative Design Process Model - The Creative Visualization for Footwear Design & Development**" published in September, 2021 issue of JILTA adjudged the Best of all articles published in JILTA in calendar year 2021 by a committee consisting of Prof. (Dr.) Sanjoy Chakraborty, OIC, GCELT and Dr. Dipankar Chaudhuri, former Scientist & Head, RCED, CLRI, Kolkata.




Mr. Mallick then declared that this year the Executive Committee of ILTA has unanimously decided to felicitate following four renowned personalities for their super excellence in their respective fields :-

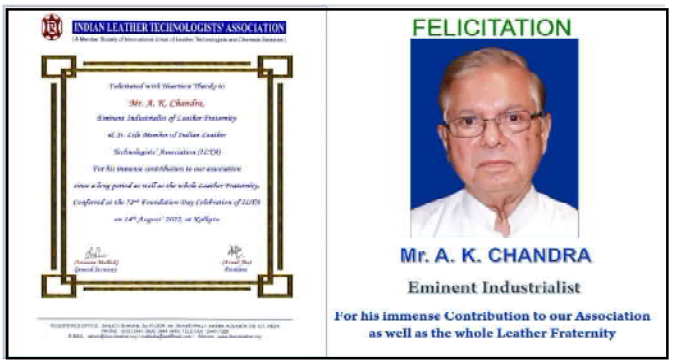
**a)** **Dr. Asit Baran Mandal**, former Director, CSIR-CLRI & a senior Life Member of ILTA for his excellent contribution to the leather science & technology.


**b)** **Dr. G. Thyagarajan**, former Director, CSIR-CLRI & a senior Life Member of ILTA for his excellent contribution to the leather science & technology.




**c)** **Mr. Amlaan Bhaumick**, an eminent industrialist of leather fraternity & former General Secretary of ILTA for his life time achievement and remarkable contribution to our association.


**d) Mr. A. K. Chandra**, an eminent industrialist of leather fraternity for his lifetime achievements and remarkable contribution to our association.




Biography of Dr. A. B. Mandal along with some Remarkable Achievements in his carrier was then read out by Mr. Mallick for the audience. Due to health constraints, Dr. Thyagarajan, Mr. Bhaumick & Mr. Chandra were unable to attend the event. But they sent their heartful thanks and best wishes as a token acknowledgement of this honour.

Mr. Kaushik Bhuiyan was requested to read out their biography and achievements. The Mementos, Shawls & Citations would be sent to their addresses in due course. Mr. Mallick then requested Dr. Mandal to say few words.

Mr. Jha then introduced **Mr. Subrata Das, Freelance Leather Technologist & Consultant** and the hon'ble Speaker of the day to the participants and requested him to deliver the Prof. B. M. Das Memorial Lecture.

Mr. Das then delivered his valuable lecture titled "Newer Trends, Opportunities and Pathways in The Application and Marketability of Leather in A Post-Covid World".

After completion of the lecture, Mr. Jha offered heartiest gratitude to Mr. Subrata Das and requested Mr. Susanta Mallick, General Secretary, ILTA, to present Memento, Shawl & Citation to Mr. Subrata Das. At the same time,

Mr. Mallick also offered the formal Vote of Thanks to the participants, members, industry and ILTA office, for successful completion of the event and their participation in large numbers and requested the audience for a High Tea.

There were about 120 - 130 participants in the event.

In the evening session of the Celebration program there was an awesome rendition of cultural events.

The eminent orchestra group namely "***Harbola***" was welcomed and greeted by Mr. Mallick with a bouquet and they presented a nice musical evening to the audience.


After the musical program, the eminent drama group "***Shyambazar Anyodesh***" was welcomed and greeted with a bouquet by Mr. Kaushik Bhuiyan, Treasurer and they presented a one act play namely "Protima Purche".


The whole cultural program was anchored by Mr. Prabir Dasgupta, a Senior Life Member of or our association.

Around 150 spectators were the witness of the colourful event and participated in a gala dinner at the conclusion.

Video recording of the entire program is available on the official YouTube Channel of ILTA **(ILTA Online)**, Facebook Page of ILTA (Indian Leather Technologists' Association) & Website of the Association – **www.iltaonleather.org**.

## 64TH ANNUAL GENERAL MEETING OF ILTA

The 64th Annual General Meeting of ILTA will be organized on Friday the 14th October, 2022 at 03.00 PM IST (Registration from 02.30 pm IST) at the Seminar Hall, of Science City, Kolkata.

The Printed Annual Report & Audited Statement of Accounts for 2021-22 along with the Notice of the 64th AGM and Proceedings of the last i.e. 63rd AGM will be posted for the members through Indian Post and also soft copy of the same will be sent to Members via email in due course.

## LEXPO – XXXXI AT KOLKATA

The Kolkata LEXPO – XXXXI which has been rescheduling repeatedly due to COVID 19 situation since last two years has now been proposed to be organized at Kolkata Ice Skating Rink from 23rd December to 1st January' 2022.

Booking money of the venue for the fair had already been deposited to the KISR authority earlier.

However, latest progress and status report regarding the proposed fair will be informed in due course.

(***Susanta Mallick***)
General Secretary

## YOUTUBE CHANNEL & FACEBOOK PAGE OF ILTA

An official **YouTube Channel** namely **ILTA Online** and a **Face Book Page** namely **Indian Leather Technologists' Association** has been launched for sharing the activities of our Association since November' 2020 and July' 2021 respectively.

You may find all the Lives / Video recordings of different Seminar, Symposiums & Webinars on both of these social medias along with our website **www.iltaonleather.org** time to time.

You are requested to kindly do **Like** & **Subscribe** the YouTube Channel and **''Follow**' the FaceBook Page to get regular updates on the activities of our Association.

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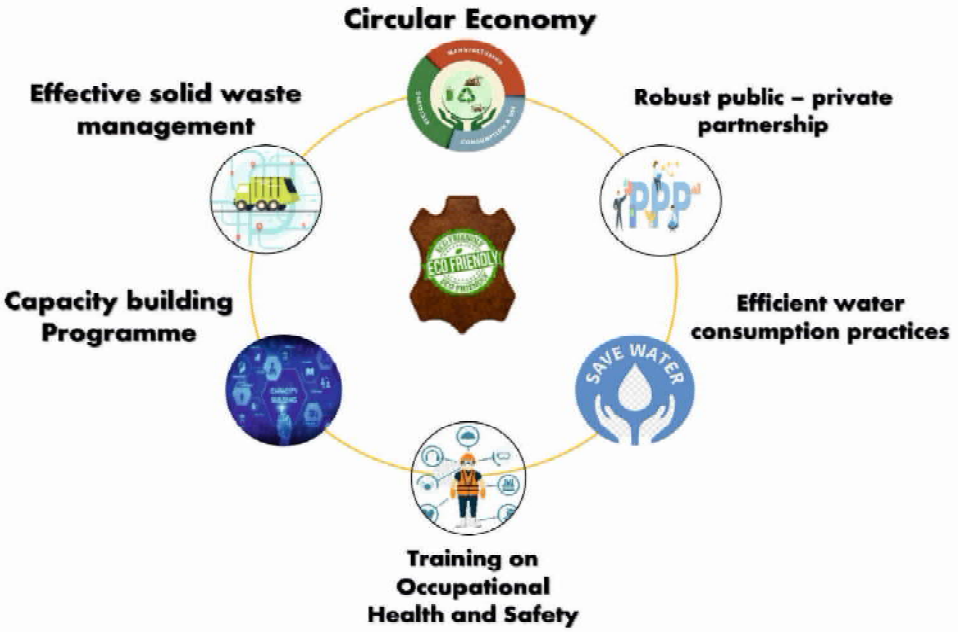
# EFFECTIVE WASTE MANAGEMENT AND SUSTAINABLE DEVELOPMENT OF MSME TANNING COMPANIES IN KOLKATA LEATHER CLUSTER (BANTALA)

## 2022-2023

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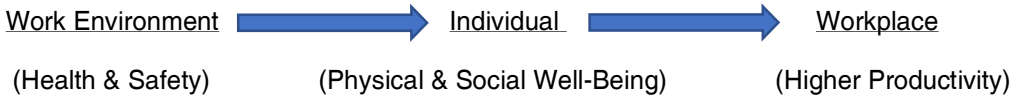
# Occupational Health and Safety (OHS) – The Need for Reform...!!!

Work is an important component of an individual's daily life. In contemporary times, workplaces demand a high degree of expertise and competency from its workers in every task they perform. The question that needs to be asked is that, are workplaces only emphasising on the 'performance of tasks' and on the 'output produced'? What about protecting and restoring well-being about the worker? This would mean addressing concerns like worker's health, safety measures with in the work place, a pleasant and secure working environment, policies or systems contributing to an employee's physical, social and psychological well-being. Thus, approaching the workplace or an occupation from the perspective of health and safety is a crucial requirement and is the vary basis of OHS.

Occupational Health and Safety (OHS) is a multidisciplinary field which deals with total well-being of a worker with recognition, prevention and control of occupational hazards in order to protect and assure worker's health & welfare.




**OHS DEVELOPMENT & CAPACITY BUILDING**

- Objective of the programme is to promote health & safety of people at work through prevention & early intervention.
- Programme aims to increase awareness of employer and employees about the safety protocols that needs to be followed at ground level for complete well-being of an individual.
- Programme has been developed to conduct OHS workshop & medical camps in atleast 100 tanneries in Bantala Leather Cluster.
- First 3 phase of workshops have been implemented in 12 tanneries and 2 goods unit covering approximatly 563 workers.
- Workshop is a combination of Medical camp and Safety protocol training conducted by experts in the field.
- **Medical camp is conducted by Dr. Ashish Mittal who has an experience of more than 25 years in OHS field of work related to MSMEs.**
- Health check up is followed by distribution of medicine and demonstration of few simple free hand exersise workouts for workers.
- **Safety protocol training is conducted by Mr. Rajshekaran who has an experience of 4 decades in the field of safety.**

It is important to appreciate that it is not only the Employer's job to provide a safe working environment, it is also the responsibility of the workers to ensure that they protect themselves and others from harm**. Occupational Health and Safety project helps both employer and employee to understand and create a safe and healthy working environment**. Work injures and illness can affect every aspect of life for workers & their families. Safety & Health are the heart of the future.


FIRST AID KIT & PPE KIT

"The OHS workshop that Solidaridad has conducted in our factory, is a great step taken towards workers health & well-being. Small things like regular ergonomics, useful daily habits which doctor is demonstrating are something that is helpful for everyone." **Mr Sanjay Jain, Vinit Gloves Manufacturing Pvt. Ltd**.

"Our workers health & safety is something which we always want to focus on. Solidaridad is helping us in achieving this goal with their OHS experts. Special mention to the safety expert visit which has benefitted us tremendously." **Mr. Shahid Parvez, Aslam Tanning Industry**

**EFFECTIVE PROGRAMME TOOLS FOR OHS**

- OHS experts educate employees on devlopment of healthy work practices & promotion of health at work.
- Training on use of First Aid kits in terms of emergency.
- Use of Personal Protective Equipment(PPE) to increase safety protocols while working and preventing workplace accidents.

- PPE kit contains 1 set of Apron, 2 pair of gloves, 1 pair of gum boot, 1 pc helmet, 1 pair of safety goggles and mask.
- Establising of support services for occupational health for longer health benefits for workers.
- Distribution of OHS kits for workers personal hygine snd safety.
- OHS kit contains antiseptic liquid, antiseptic ointment, Pain releif spray, creap bandage, dry gauze, band aid, cotton, pair of scissors, nail cutter, ear buds, paper soap & digital thermometre.



"Safety of workers and safety in factory goes hand in hand. Medical camp by doctor & tannery visit by Safety expert is a very good initiative where workers are getting direct benefits and this is indeed a positive step taken towards making working conditions better." **Mr. Tahir Alam, Trident Leather**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# DESIGN AND DEVELOPMENT OF LOW - COST AUTOMATIC EVA GRANULE DISPENSING MACHINE

**[1]Kabir Gupta, Vishal Vats, Sourabh Singh, [1*]Arjun Verma, [2]D.K. Chaturvedi**

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**ABSTRACT**

This paper is based on the design and development of a low-cost automatic EVA dispensing machine. The purpose of the dispenser is to weigh EVA granules automatically and precisely. During the manufacturing of EVA shoes using EVA Press molding, the weight of the granules is to be measured for each size of shoe. This operation is done manually and hence, it is a time-consuming process and there is a chance of error during measuring. The need of this concept resides in the fact that the price of a shoe is decided by the time consumed and the labour required. To reduce this time consumed and chances of error, it was decided to study the results from the manufacturing process and find out the optimum amount of the material requirements for each size of shoe and then develop an automatic dispenser to perform the weighing task. It was aimed to keep the cost as low as possible. This will have a direct influence on the cost of shoes. The machine design comprises of a dispensing mechanism which is controlled by a control board based on microcontroller. The load cell is connected to the control board for measuring the amount of the material during the dispensing cycle and control the dispensing mechanism. The dispensing mechanisms has been used to develop the dispenser, horizontal screw (auger) and pneumatic cylinder.

**Keywords :** EVA, Microcontroller, Load cell, Auger, Pneumatic, Dispenser, Shoe last, Granules.

## 1.1 INTRODUCTION

Nowadays, the type of shoe is decided by its purpose. If it is used for running purpose, it is called running shoe. If it is used for dancing, it is called dancing shoe and so on. It is not possible to purchase various shoes for various purposes. At the same time people also want cheapest shoes. In this section, it has been designed a single piece of material model using EVA granules with the help of automatic dispenser machine [1]. The price is decided by the time consumed and also the number of workers or machines required, it is essential to keep these factors as low as possible. This report is based on the development of a low-cost automatic EVA granule dispenser which can automatically weigh EVA granules accurately and precisely. So, it can reduce the time and labour cost in the process of EVA shoe manufacturing [2-3].

## 1.2 MOTIVATION

Eva shoes that are manufactured by small scale industries are very low cost. This makes them available to the whole population of an area no matter rich or poor. But it is also possible to minimize its cost to more extent. This can be done by understanding the process and removing those things which plays a vital role in increasing the cost of that shoe. One such thing is measuring the weight of EVA granules since this operation requires time and labour. If this operation could be automated at minimum cost, then labour cost and time consumed both became less which have direct influence on cost of shoes. During the manufacturing of EVA shoe in tannery campus of D.E.I. Dayalbagh, Agra, the people who operated this process for making shoes had to manually measure the granules for the odds of various sizes and the weight is sometimes not accurate. They worked with hit and trial method with the EVA material granules and adjusting the operating temperature according to the weight of EVA material for

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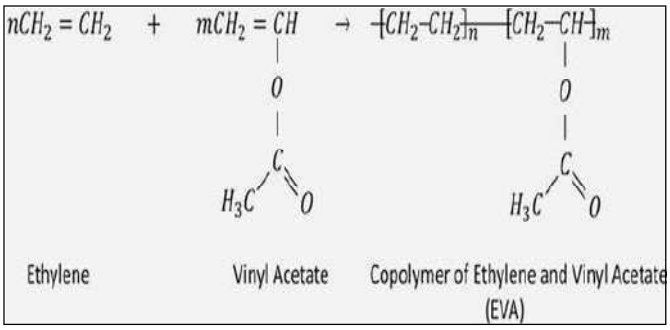
particular size. It was observed that the accuracy was not maintained at the time of manufacturing. So, from here it was proposed to solve the problem by developing an automatic EVA granule dispenser.

### 1.3 PROBLEM STATEMENT

It requires more time to measure the granules manually in manufacturing EVA shoes, in addition to less accuracy achieved. It is not known, what should be the exact operating parameters for manufacturing EVA shoe. On daily basis, hit and trial method was performed and observed the readings at which the exact shoe is made and then continue the process. As a result, there is wastage of both time and EVA material. So, with the help of a low-cost EVA granule dispenser machine, the process could be automated with much less labour intervention and much more accuracy.

### 1.4 EVA (Ethylene Vinyl Acetate)



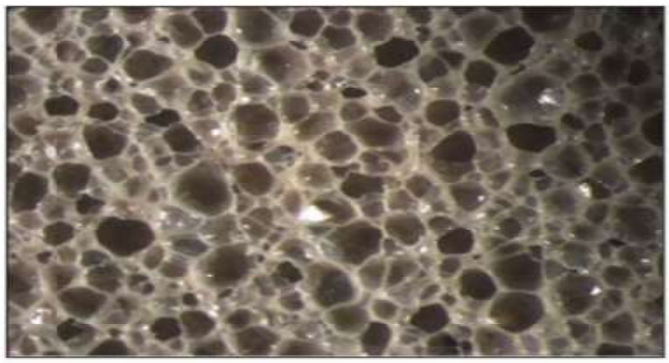



**Fig.1** Close picture of open celled EVA [b]

Foam is created as the gas bubbles are trapped inside in a chemical resin. It can be created through an endothermic or an exothermic reaction. It starts when a solid and whichever process is going to be used, foaming occurs which creates the cell structure and, ultimately, foam [4]. In general, the most common closed cell foam is manufactured by the endothermic and the open cell by the exothermic process. In Open cell, the foam contains bubbles which are interconnected with each other in a wide web. Open cell foam may be soft and it will absorb any liquid when it comes in contact with it [5-6]. It is perfect for so many applications, especially if you require the extreme softness and there is no contact with a liquid environment.

**Fig.2** White EVA granules

**Fig.3** Black EVA granules

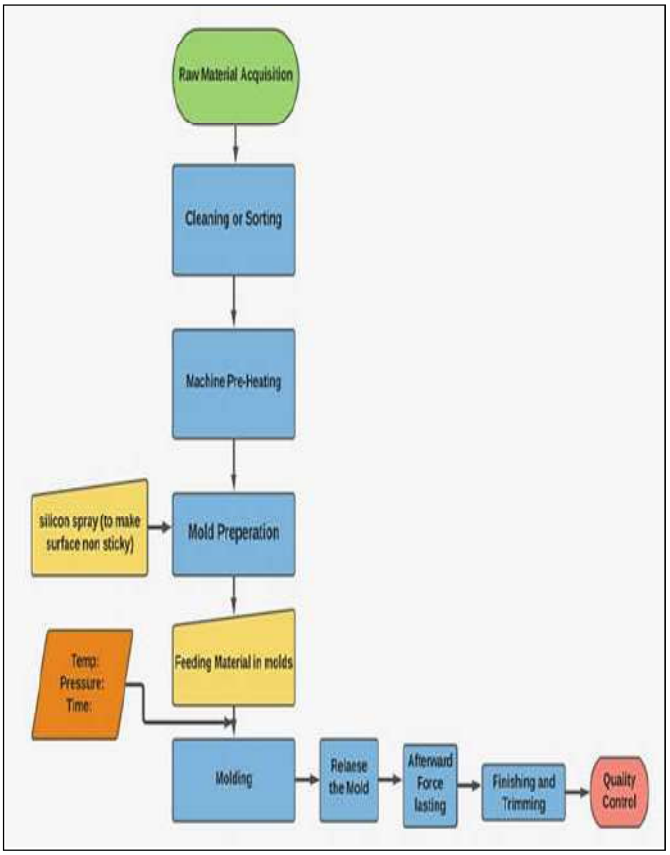
### 1.5 EVA Press Molding

Compression molding is a method of molding the polymer material, generally the preheated and should be placed in an open heated mold cavity chamber. After this, we need to close the mold with a top force or plug member and then pressure is applied to force the polymer material in contact with all the areas in a mold, during this pressure and heat are maintained properly until the molding material has been cured. Once the molding process is completed, we need to remove the excess material [7]. This process employs thermosetting resins in a partially cured stage, which are either in the form of granules, putty-like masses, or preforms. In compression molding, we have to focus the five points while dealing with it :

- ❖ To determine the proper amount of EVA material.
- ❖ To determine the minimum amount of energy required to heat the material.
- ❖ To determine the minimum time required to heat the material.
- ❖ To determine the appropriate heating technique.
- ❖ To predict the required force which ensures that shot attains the proper shape.


**Fig.4** EVA Press Molding Machine

### 1.6 FLOWCHART OF EVA PRESS MOLDING




## 2 LITERATURE REVIEW

### 2.1.1 HIGH-SPEED PRECISION WEIGHING OF PHARMACEUTICAL CAPSULES [A]

**Author : Miran Bürmen University of Ljubljana, Slovenia**
**Source** : ResearchGate

**ABOUT THE PAPER :** A cost-effective method for fast and accurate in-line weighing of hard gelatin capsules based on the optimized capacitance sensor and real-time processing of the capsule capacitance profile resulting from 5000 capacitance measurements per second.

- The method was tested on two types of hard gelatine capsules weighing from 50 mg to 650 mg.
- The results showed that the capacitance profile was exceptionally well correlated with the capsule weight with the correlation coefficient exceeding 0.999.
- The mean precision of the measurements was in the range from 1 mg to 3 mg, depending on the size of the capsule and was significantly lower than the 5% weight tolerances usually used by the pharmaceutical industry
- Therefore, the method was found feasible for weighing pharmaceutical hard gelatine capsules as long as certain conditions are met regarding the capsule fill properties and environment stability.

### 2.1.2 BELT DISPENSER

The belt disperser is designed to dispense on free-flowing materials or material that tend to compact in storage and bridge during discharge. It consists of a metal mat or rubber belt which serves as the floor of the storage bin, and a strike off gate to regulate the amount of material pulled from the bin. Although out-put varies with operating conditions (aggregate size, trash and moisture content) the dispenser is reasonably accurate; it is the most expensive because of its low-speed, high torque drive unit.

### 2.1.3 SCREW DISPENSER

Screw dispensers allow for dispensing by volume and weight. A screw is the working body of the disperser of this type. The amount of volume of the bulk is determined by the number of Screw revolutions. In front of the screw, agitators are installed

in the loading hopper, which, by mixing the working medium, prevents its clumping and arching. The invented screw dispersion is installed on Vibration supports, and provides bulk and granular materials dispersing by weight and volume and is aimed at improving the accuracy of dispersing. Another type of screw dispenser at granules, prevents the sticking of bulk products on the walls of the device by installing a vibrator on the wall of the dispenser discharge Channel solve the problem of designing a dispenser device capable of controlling and effectively discharging the granules material.

### 2.1.4 VACUUM-BASED DISPENSER

The movement of the product is realized due to the pressure drop a feeder Vacuum dispenser is connected to the airtight Container through a Vacuum system, the elastic properties of the granular material, allows its walls to self-shake during the dispense process. According to the method a vacuum is created in the hopper by pumping gas out of it, as a result of which a mixture of granules with gas enters the hopper through the pipeline. When a certain amount of pressure drop is reached, on the material layer in the hopper, the material is discharged through the discharge pipeline under the action of gravity.

### 2.2 Automation Delivery Device for granules material based on PLC [B]

**Yongdong (2018):** The aim of the study is to feed poultry accurately and efficiently. The traditional method of feeding poultry is done by farmers which has some problems and requires a lot of manpower and resources, and a lot of resources and power waste. So, to feed automatically, accurately and efficiently. This paper proposed a design for granules dispensing machine for feeding of poultry from using PLC. This device uses PLC of SIEMENSS7-200 type, CPC of 222 type, 24 V DC power supply, proximity switches, TCA-3050A, NPN output type, Detection distance device, relay RJ25-CL-D24 model etc. Error can happen in PLC coding, in feeding time. But this device also has advantages, like easy to control, pellet delivery device has strong expansion etc. so, using this device reduces our work load.

### 2.3 WAYS TO INCREASE DOSING PRECISION OF GRANULAR FOOD PRODUCT THE BATCHER DISCRETE ACTION [C]

**Gvva, krivoplyas, kohan (2016):** The aim of this study is to increase dosing precision of granular food products. There are two main phases for dispensing bulk products : Volume and Weight. In weight phase method error can be of three types :

- Drift
- Static
- Dynamic

In this paper they try to minimize errors in these two phases. To improve weight accuracy requires determination and setting of individual technological regime for specific bulk material and metering devices. To improve volumetric accuracy, it is divided into two technological and structural. On the basis of study accuracy can be improved in two ways: technological and structural. This paper proposed and proved the effectiveness of tubular telescopic measuring cup dispensers that implement a dual batch volume method.

### 2.4 EXPERIMENTAL RSEARCHES OF THE CONE-BELT DISPENSER [D] HAGYMÁSSY, ANCZA, GINDERT KELE (2009):

The main aim of this experimental research is to spread different types of fertilizers more accurately and evenly in plots. This research offered a mechanization of distribution of fertilizers on plots. The unevenness of spreading of each type is significantly influenced by the tilt of the cone-belt dispenser from vertical position also considered in this research. Error can occur while giving tilt to the cone of the machine.

## 3. DESIGN AND DEVELOPMENT OF LOW-COST AUTOMATIC EVA DISPENSING MACHINE

The basic design of the machine includes a feeding mechanism, a control board and weight measuring unit. The control board is to be designed for controlling the feeding mechanism and taking input from the weight measuring unit. The control board consists of a microcontroller to control all the operations in the machine including inputs from user, displaying output, inputs from load cell, and controlling the feeding mechanism. The feeding mechanism could include components such as geared motor, horizontal screw, pneumatic cylinder, solenoid, vibration motor etc. Based on the mechanism, the components included might be different. The weight measuring unit basically consists of a load cell and a top plate (for placing containers), along with the amplification circuit for the load cell signal. A basic flowchart of the working of machine is shown below.

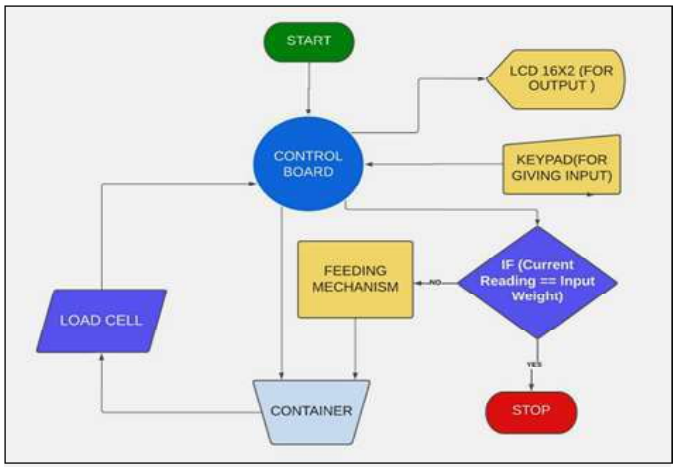



**Fig.5** Flowchart of dispensing machine

### 3.1 AUGER (SCREW) CONVEYOR FOR DISPENSER

A screw conveyor or auger conveyor is a mechanism that uses a rotating helical screw blade, called a "flighting", usually within a tube, to move liquid or granular mate conveyors in modern industry are often used horizontally or at a slight incline as an efficient way to move semi solid materials, including food waste, wood chips, aggregates, cereal grains, anima bone meal, municipal solid waste, and many others. [Auger]

The basic design of a horizontal screw conveyor has been shown in the diagram below -

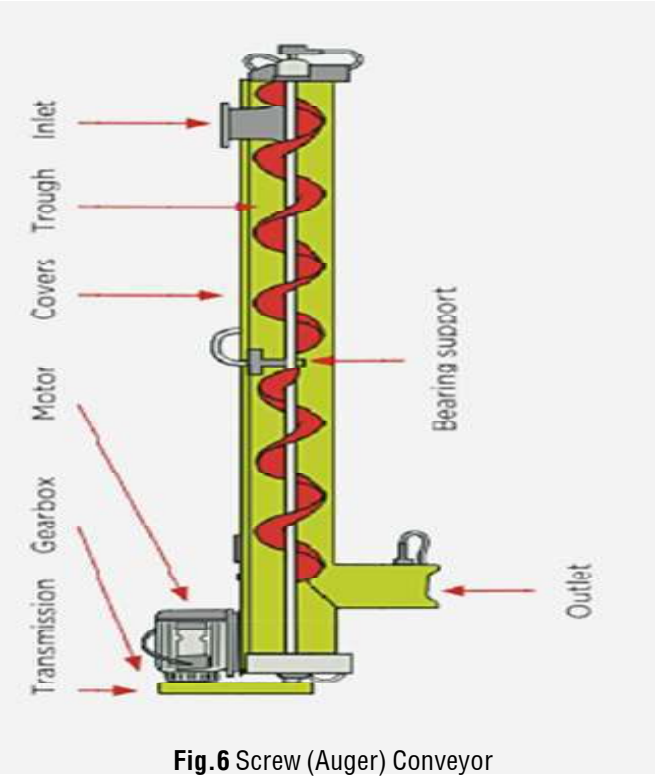



**Fig.6** Screw (Auger) Conveyor

The mechanical section the project consists of the following components:

- Circuit box
- Back walls, Front wall & Side walls
- Hopper
- Auger
- Pipe
- Control Panel & Load cell Plate

### 3.2 AUGER (SCREW)

A 3d model of the auger was made using the SOLIDWORKS. The model was first printed in a smaller size and then the final print was made to the actual size.

### 3.3 ELECTRONICS SECTION

The electronics section the project consists of the following components:

- Transformer 0-12V 3A
- Transformer 0-9V 0.5 A
- Rectifier Circuit
- Arduino UNO
- Arduino UNO Shield
- Mosfet Driver Circuit
- 12V Johnson DC Gear Motor
- Load Cell 3kg
- HX711 Amplifier Module
- LCD Display 16 X 2
- I2C module
- Control Buttons and Indicators

### 3.4 FLOWCHART OF AUGER BASED AUTOMATIC EVA DISPENSER

The basic working of the machine can be described in the flowchart below-

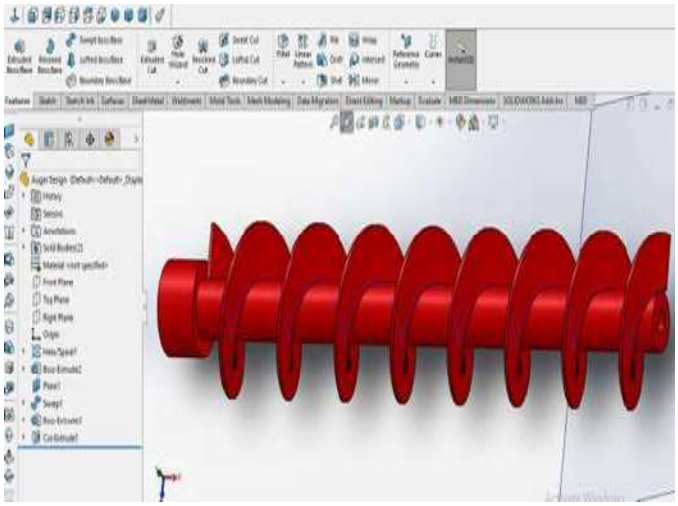
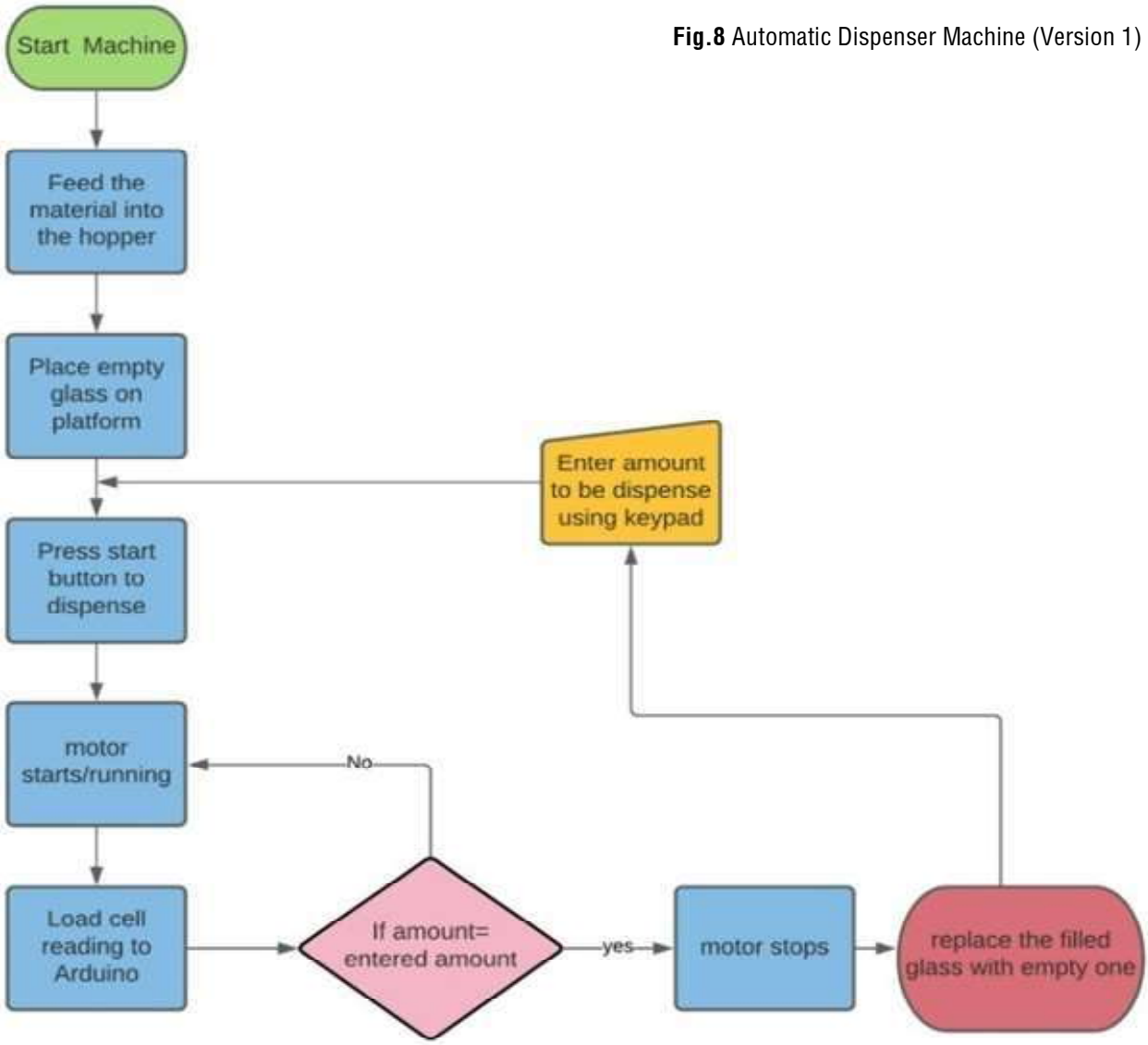


**Fig.7** Auger Design (SOLIDWORKS)

**Fig.8** Automatic Dispenser Machine (Version 1)



### 3.5 PNEUMATIC CYLINDER BASED DISPENSER MACHINE (VERSION 2)

A second version of the machine has been made, which makes use of pneumatic (air) pressure to control the flow of granules, a hopper has been arranged vertically over the load cell to measure the granules falling in the container. This version has been made using a dedicatedly designed circuit based on Atmega-16 microcontroller.

The main components of the circuit are as follows:

- Pneumatic Cylinder
- Pneumatic Solenoid Valve
- Solid State Relay
- Pneumatic Hopper Nozzle
- Circuit Box
- Frame
- Blocking Plate
- Control Board
- Control Panel & Buzzer

### 3.6 PNEUMATIC CYLINDER

Pneumatic cylinders, also known as pneumatic actuators, are the products used to provide linear or rotary motion and force to automated systems, machines and processes, for example in industrial applications.

A round line pneumatic cylinder has been used for providing motion to the blocking plate for the purpose of opening and closing of the nozzle.

Round line Cylinders are ideally suited to lighter duties and in lower force applications, and are available as single or double acting cylinders.

### 3.7 CONTROL BOARD

The control board for the second version of the machine was developed using the ATMEGA-16 microcontroller. It integrates all the outputs required for the machine such as :

- Pneumatic circuit control
- Vibration motor control
- Inputs from load cell
- Inputs from push buttons
- LCD interfacing
- Buzzer output

### 3.8 FLOWCHART OF PNEUMATIC CYLINDER BASED AUTOMATIC EVA DISPENSER

The basic working of the machine can be described in the flowchart below:

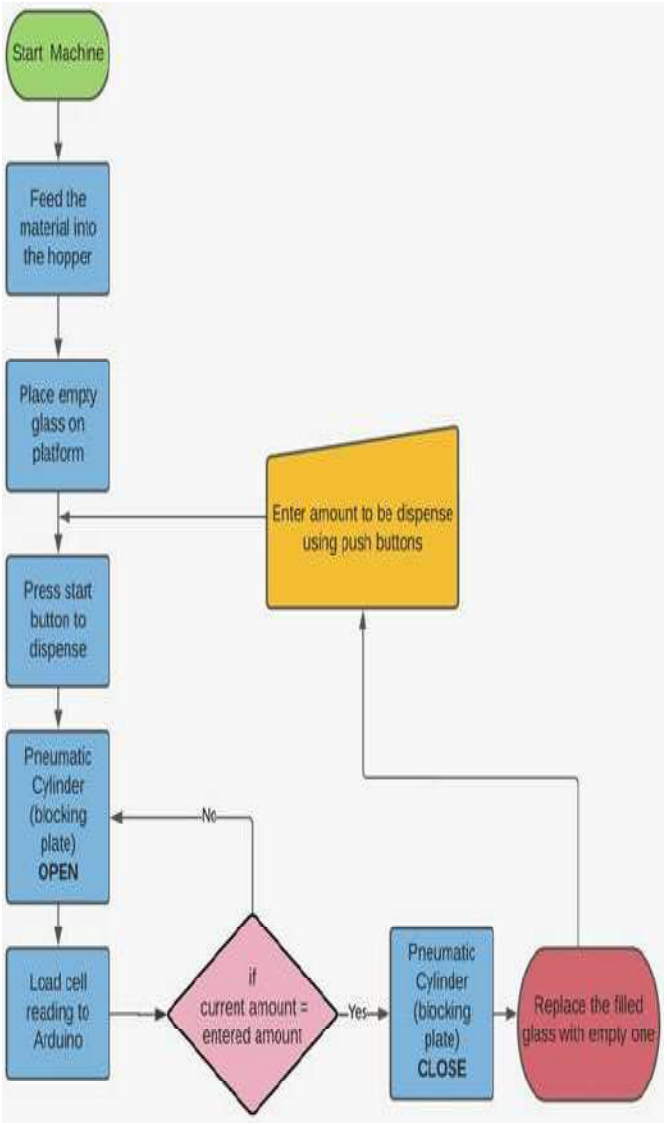


**Fig.9** Automatic Dispenser Machine (Version 2)

**Images of final EVA shoe**

**Fig.10** Side view of Black EVA shoe

**Fig.11** Side view of White EVA shoe

**Fig.12** Side view of Grey EVA shoe

**Fig.13** Top view of Black EVA shoe

**Fig.14** Top view of White EVA shoe

**Fig.15** Top view of Grey EVA shoe

## CONCLUSION

This report is mainly focused on the development of a Low-Cost Eva Granule Dispensing Machine which can be used in the EVA Press molding for the manufacturing of EVA shoes. This machine can also be used for dispensing various other materials which are in granular form. The process of measuring EVA granules manually for various odds of different sizes can be much time consuming and can affect the production rate to a large extent. Two prototypes have been developed using two different mechanisms. The first machine uses the AUGER dispensing mechanism for dispensing the particular amount of EVA granules into the container as entered by the user using the keypad.

The second machine uses a PNEUMATIC Cylinder for controlling the flow of granules with the help of blocking plate, while the granules get dispensed into the container. The accuracy achieved by both the systems is different. The auger-based approach is better than the pneumatic cylinder. The accuracy achieved was found within 0.5gram with the former, while the latter reaches the accuracy within 2 grams. Hence, the proposed design based on auger has proven to highly efficient in measuring the exact amount of weight entered. The LCD display serves as user interface and shows the various details while operating the machine. The machine eliminates the engagement of an operator for measuring the required amount. It also eliminates wastage of material during the measuring process. These prototypes can be further developed for the production-based machines that will result in high efficiency in the production activity of manufacturing of EVA shoes using EVA Press molding.

## FUTURE SCOPE

These prototypes were made to examine the possibility of using different dispensing mechanisms for automatically dispensing the fed amount of EVA granules into a container, for the use in EVA Press Molding. The prototypes have successfully served the purpose. Although, we have put our efforts to optimize the design of both hardware and software, there is always a room for improvement. The electronics of the machine can be further improved by using more accurate amplifier ICs for reading the load cell, and using a specifically designed circuit board for the machine, based on a dedicatedly chosen micro-controller for the machine. Further, the machine can be provided with WIFI connectivity using modules such as ESP8266. The data of the dispensed amount can be further recorded on a server and the feedback from the operator can be used for evaluating the results for research purposes. The outlet of the machine can be installed with a servo motor for numerically controlling the dispensing activity and further improve the accuracy of the machine. A vibration motor can be installed into the hopper. This would prevent any blocking of the granules before entering the auger chamber (pipe) in the first version and minimize the variability in flow rate of granules in the second version.

The current from the motor can be monitored for detecting any obstruction in the rotation due to the stucking of material between the clearance of auger and pipe. A mechanism to indicate emptying of the hopper would also make the machine's operation easier. There can more possible solutions to this problem. Other mechanisms can be improved to serve this purpose or a more advance and accurate system can be designed by combining various mechanisms for dispensing of material into a single system. The future scope for the development of this prototype can be summarized below :

- Vibration Motor for hopper
- Current monitoring of the motor for detecting obstruction.
- Numerically controlled outlet of the machine
- Hybrid dispensing mechanisms
- WIFI connectivity for data collection to a remote server (system)

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**WEBSITES FOR IMAGES**

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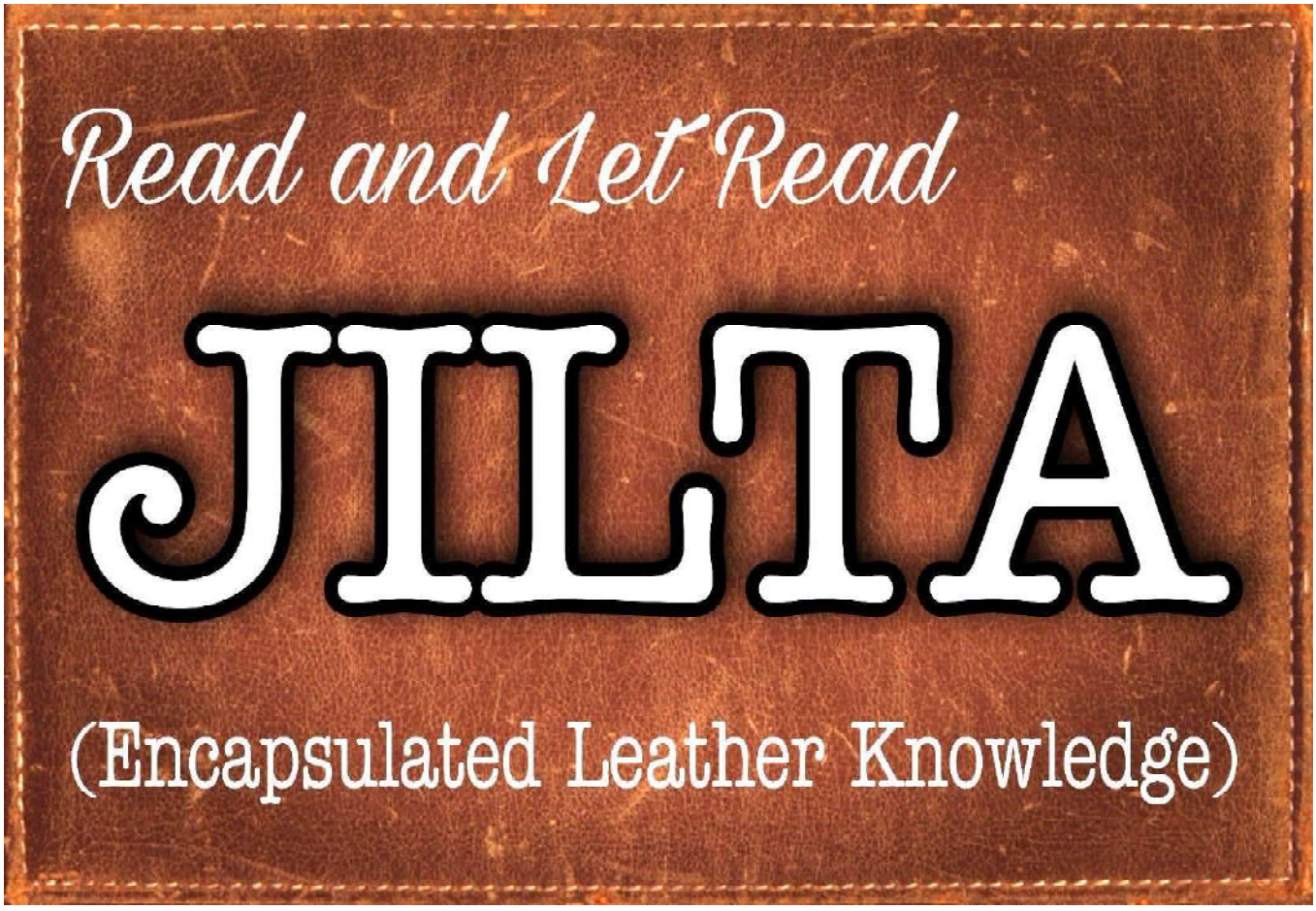


INTERNATIONAL UNION OF LEATHER TECHNOLOGISTS AND CHEMISTS SOCIETIES
(www.iultcs.org)

# WELCOME TO ASIA INTERNATIONAL CONFERENCE OF LEATHER SCIENCE AND TECHNOLOGY


It is with great pleasure, that we invite you to participate in the 12th Asia International Conference of Leather Science and Technology (AICLST), hosted and organised by the New Zealand Leather & Shoe Research Association in the beautiful and picturesque city of Queenstown in New Zealand's South Island on 18-20 Oct. 2022.

Queenstown sits on the shores of the South Island's Lake Wakatipu, set against the dramatic Southern Alps. Renowned for adventure sports, it's also a base for exploring the region's vineyards and historic mining towns. There's bungee jumping off Kawarau Gorge Suspension Bridge and jet-boating on the Shotover and Dart rivers. There is also the possibility of skiing on the slopes of The Remarkables and Coronet Peak.

The three-day programme promises excellence in science, along with practical examples of science impact and the drive to sustainable leather production. We seek to foster strong and lasting bonds between leather scientists across the international community with companies engaged in leather production and chemical companies who deliver the products used to manufacture leather.

**Main Topic Areas:**

- Advances in Basic Science of leather
- Benign chemical developments
- Cleaner leather production and closed-loop processing
- High value uses for leather manufacturing by-products and wastes
- Technologies to advance protection of the environment in the leather industry
- Advances in detection technologies applied to leather manufacture and quantification
- Intelligent leather technologies – Industry 4.0
- Design innovation for fashion leathers


INTERNATIONAL UNION OF LEATHER TECHNOLOGISTS AND CHEMISTS SOCIETIES

# IULTCS ASKS EU LEGISLATORS TO RECONSIDER PROPOSED RESTRICTIONS

Members of IULTCS have collaborated with industry scientists from FILK, Stahl and TFL to prepare a document that was submitted to DG Grow (the European Commission Directorate-General department responsible for EU policy on the single market, industry, entrepreneurship and small businesses) and DG ENV (The Directorate-General for Environment department responsible for EU policy on the environment).

The purpose of preparing the document was to address proposed EU restrictions on the presence of Chrome VI and Bisphenols in leather. It is considered that the new proposed REACH restrictions could seriously impact the leather industry, particularly in the European Union.

The IULTCS document asks the EU forflaflproper assessment of the impact of these measures on the environment, people and leather manufacture.flIULTCS President Jean-Pierre Gualino and Executive Secretary Dr Luis Zugno stated "Ourflcall is for a more detailed study of data and testing methodology relating to Chrome VI and more time to implement the proposed Bisphenol restrictions".

NOTE: Copy of document sent to DG GROW / DG ENV is as follow :

*(IULTCS News Release - 02/09/2022)*

IULTCS INTERNATIONAL UNION OF LEATHER TECHNOLOGISTS AND CHEMISTS SOCIETIES

The International Union of Leather Technologists and Chemists Societies, a world-wide organization of professional societies, was established in London in 1897. There are currently 19 Member Societies, 6 Associate Members and 1 Supporting Member - representing some 3000 individual members.

This document represents the IULTCS opinion regarding the new proposed REACH restrictions that could seriously impact the leather industry, particularly in the EU. We call for more data regarding Chrome VI and more time to implement the bisphenol restriction.

**Chrome VI**

Proposal from ECHA: Reduce Chrome VI limit in leather from 3 ppm to 1 ppm

In our opinion there is no scientific base to change the existing limit to a lower value based on the existing ISO test method. The current ISO method is the best result of many studies and investigations, and is deemed to be the most accurate process to establish a reliable detection limit. Although detection can be reproduced, even at 1 ppm, the necessary upstream process, the extraction of the reagent out of the leather matrix, cannot be reproduced to a higher accuracy than 3 ppm. Too many false positives and negatives would be the result of lowering the detection limit. As long as this is the case, and no other extraction process is in place, there is no scientific justification to lower the detection limit of the existing ISO method.

The industry would welcome the opportunity to develop and introduce a new method because the existing test method for

measuring Chrome VI in leather (ppm total Chrome VI) does not address the skin exposure to the leather that can cause sensitization; it relates to mg of Chrome VI to one kg of leather. Most leather does not come in direct contact with the skin. Leather articles are typically lined with fabric or non-woven or finished, therefore skin exposure directly to the leather surface is rare and represents the worst-case scenario for Chrome VI sensitization.

Our proposal is the evaluation of the Chrome VI surface transfer using standardized rubbing studies and commercial leather samples with 3 ppm Chrome VI or more. The rubbing studies (e.g. Veslic, Crock and Martindale) should be done with perspiration solutions under dry and wet conditions with, and without, aging. This study can determine the proper Chrome VI concentration expressed as $\mu g/cm^2$, and would address the potential risk of skin sensitization, that can induce localized allergic contact dermatitis (ACD). Research exposure assessment studies indicate that a limit of 3 ppm Chrome VI in leather is safe.

## Bisphenols (BosC)

Proposals from ECHA:

| |
|---|
| 1. Shall not be placed on the market in mixtures and articles in a concentration equal to or greater than 10 ppm (0.001% by weight). If the concentration in mixtures and articles exceeds 10 ppm, a migration test to determine the migration values need to be conducted (2) |
| 2. Shall not be placed on the market in articles showing a migration value greater than 0.04 mg/l (migration limit) in total during its service life. This migration limit refers to sum of BPA and all BosC present in the respective mixtures and articles |
| 3. Paragraphs 1 and 2 shall apply 24 months from entry into force of the restriction |

Table 1: ECHA Proposal

Bisphenol F and S are impurities present in syntans used in leather manufacturing. Bisphenol S can also be present as unreacted reagent on sulfone based syntans. The syntans are water soluble tanning polymers (synthetic re-tanning products) used to complete the tanning of several types of chrome-free leathers or as retanning agent to improve the softness, fullness, filling, temper, buffing of the leathers.

1) Today commercial leathers cannot be made successfully without syntans.

2) In leather application it is not technically feasible to meet the 10 ppm BosC proposed concentration limit, nor the 0.04mg/l migration limit.

3) The existing syntan building blocks will not be able to achieve the requirements outlined in Table 1, i.e., the improvements in the syntans manufacturing processes will not enable us to meet these requirements. We will need new chemistries which are not currently available.

4) IULTCS is developing an ISO method for the determination of bisphenols in leather. The test method probably will be ready mid-2023. The bisphenols determination method in chemicals is also being developed.

We ask for the EU regulatory authorities to evaluate our review in light of the science, to make the proper assessment for the impact of these measures on the environment, people and leather manufacture.

*(Dated : 30/08/2022)*

**President:** Jean-Pierre Gualino
**Executive Secretary:** Dr. Luis A. Zugno
**IULTCS**, c/o NOFIBA Audit AG, Beim Goldenen Löwen 11, 4052 Basel, Switzerland
**Website**: www.iultcs.org Email: office@iultcs.org

INTERNATIONAL UNION OF LEATHER TECHNOLOGISTS AND CHEMISTS SOCIETIES

# REGISTRATION FOR VIRTUAL PARTICIPATION IN ROMANIAN MATERIALS CONFERENCE (ICAMS) UNDERWAY

The National Research and Development Institute for Textiles and Leather (INCDTP) Leather and Footwear Research Institute (ICPI) Bucharest, Romania announces thatfl**the 9th International Conference on Advanced Materials and Systems ICAMS 2022**□- will be held virtually in Bucharest, Romania, onfl26 – 28 **October 2022.**

ICAMS 2022 intends to bring together eminent scientists, technologists and young researchers from several disciplines across the globe to provide a common platform for discussing their achievements and newest directions of research. Specialists are invited to participate in this event which is held every two years.

Topics included on the scientific programme are:

- Advanced Materials and Nanomaterials
- Biomaterials and Biotechnologies
- Innovative Systems, Technologies and Quality Management
- Ecological Processes for Circular and Neutral Economy
- Creative Industries and Cultural Heritage
- Education and Digitalization

For further information contact: icams.ro@gmail.com (Website : www.icams.ro)

## CENTRAL GOVERNMENT OFFERED SEED FUNDING FOR PROSPECTIVE START-UPS AND ENTREPRENEURS IN THE DOMESTIC LEATHER SECTOR.

Union Minister of State (Independent Charge) Science & Technology; Minister of State (Independent Charge) Earth Sciences; MoS PMO, Personnel, Public Grievances, Pensions, Atomic Energy and Space, Dr Jitendra Singh said in Mainpuri, Uttar Pradesh today that India's leather industry is offering world-class opportunities for StartUp and entrepreneurship.

Addressing senior scientists and officials of CSIR-CLRI (Central Leather Research Institute), Kanpur and College students at Mainpuri in Uttar Pradesh, Dr Jitendra Singh called upon the youth to look for lucrative career in the upcoming leather Start-up ecosystem. He said, leather industry in India has exhibited consistency in high export earnings and it is one of the top ten foreign exchange earners for the country.

The Minister also offered seed funding to prospective Start-ups and innovative entrepreneurs from Technology Development Board under Department of Science and Technology at the centre, which he is heading.

Dr Jitendra Singh assured the students and youth of Mainpuri and adjoining districts that CSIR-CLRI (Central Leather Research Institute), Kanpur will be instructed to organise specific activities like Survey of leather and allied industries, Practical demonstrations, Trade counselling, Vocational and Tailor-made Training Programmes, Consultancy Services, Students' Internship at regular intervals for promoting leather start-ups and businesses.

Dr Jitendra Singh pointed out that the Uttar Pradesh Government under Yogi Adityanath has identified leather goods as an ODOP (One District One Product) for Agra & Kanpur districts and formulated strategic interventions for development of these clusters. He said, t Uttar Pradesh is trying hard to create an enabling ecosystem of export growth and support exporters in scaling up exports of leather goods from Uttar Pradesh. The Minister said, this will open up new opportunities for the entrepreneurs and youth of Mainpuri and adjoining districts.

Dr Singh said, India is the second largest producer of footwear, second largest exporter of Leather Garments, fifth largest exporter of Leather Goods and third Largest Exporter of Saddlery and Harness items. He said, the global leather goods market size is valued at $424 billion in 2022 and expected to reach USD 744 billion by 2030 and added that India must tap the huge potential in the global leather pie.

Dr Jitendra Singh said, only youth with innovative thinking can fulfil the rising demand for comfortable, trendy, and fancy leather apparel, footwear, and accessories as leather products are often seen as a status symbol and provide a stylish look.

Abhinandan Kumar, Scientist-In-Charge made a presentation on the status of Kanpur Leather cluster and the activities of the CLRI Regional Centre Kanpur, showcasing various technologies available with CLRI for pollution abatement and value addition in leather making, which would help the industry in achieving environmental compliances and help in better unit value realisation. It was also mentioned that a testing facility for all physical and chemical testing needs of leather and leather products industries is being offered from recently acquired laboratory at KLC Complex, Bantala which helps the industry in ensuring quality at national as well as international standards.

CLRI Regional Centre - Kanpur is one of the four extension centres of CLRI. It was established in 1963 to benefit the Leather and Leather products industries in the states of Uttar Pradesh and Madhya Pradesh. The centre is fully equipped with Chemical, Physical & Eco testing Laboratory. This centre has a pilot Tannery which provides varied services to the industry.

*(Press Information Burau – 29/08/2022)*

## TAMIL NADU SIGNS PACT TO INVEST □¹ 2,250 CRORE IN LEATHER SECTOR


Tamil Nadu government inks pact for ¹2,250 crore investment in leather sector and launched state footwear policy in the Footwear and Leather Sector Conclave on Tuesday. The policy will aim to boost leather as well as non-leather footwear industry in the state. India's leading exporter in the leather industry, Tamil Nadu, has announced an investment of ¹2,250 crore in the footwear and leather sector and launched an annual policy for the industry in Tamil Nadu Footwear and Leather Sector Conclave 2022.

The state government signed five memoranda of understanding (MoUs) for the investments in the presence of CM MK Stalin who launched the 'Tamil Nadu Footwear and Leather Products Policy 2022'. The government has signed MoUs with five firms that include KICL SEMS, Wagon International, KICL, Walkaroo, and KICL (footwear cluster). The step will help the sector in attracting ¹20,000 crore investment by 2025 and generate employment for 2 lakh people. Along with the launch of the annual policy and signing of MoU, CM laid the foundation stone for a Rs. 400 crore mega footwear manufacturing park at Panapakkam, Ranipet.

In the program, Tamil Nadu CM expressed his confidence that the measures taken in the coming time will transform Tamil Nadu into the most favoured destination for the manufacturing of footwear and leather products in Asia. Moreover, he appealed to the industries to popularise 'Make In Tamil Nadu' products at a global level. "To achieve the USD 1 trillion economy by 2030, Tamil Nadu should attract capital-intensive high-tech industries and employment-intensive industries," said MK Stalin.

**Tamil Nadu: A hub of global footwear brands**

It is worth noting that the state is associated with several global fashion brands like Louis Vuitton, Giorgio Armani, Gucci, Clarks, Cole Haan, Daniel Hechter, Bugatti, Prada, Zara, Coach, Tommy Hilfiger, Hush Puppies, Ecco, Johnston & Murphy, Hugo Boss, Pierre Cardin, etc. These brands have established their manufacturing industry mainly in Tamil Nadu and many of them acquire the raw materials for the manufacturing from the state only.

"The state accounts for a fairly large number of footwear and leather manufacturing units in India. Leather goods made in Tamil Nadu have great demand in the international market," the Chief Minister said while presiding over the event. Ambur, Ranipet, Vaniyambadi, Vellore, Peranampattu, Tiruchirappalli, Dindigul, Erode, and Chennai are among the major centres for leather and leather goods production. He also informed that Tamil Nadu is the only state in the country to implement Zero Liquid Discharge in tanneries.

As per the policy document, "The state has a well-established industrial ecosystem of high-performing sectors such as electronics, textiles, information technology, auto-mobiles, and auto-components." The policy will lay special emphasis on enhancing the productivity of existing players and bolstering the industry ecosystem in the state. Ultimately, it will help in making Tamil Nadu the most favoured destination for footwear exporters.

**Tamil Nadu contributes 26% to national manufacturing output**

Being a leading contributor to India's leather products exports, Tamil Nadu is known for its traditionally crafted leather products. Moreover, the state has shown huge progress in the growth of the footwear sector. Its contribution to the national manufacturing output has increased to 26% and enjoys a share of 48% of the national exports.

The existing footwear manufacturing clusters in Tamil Nadu can be leveraged to address the growing domestic demand and export requirements for footwear, the policy stated. It also aims to launch clusters, parks and common facilities to strengthen the industrial infrastructure in the state. This will help the state in building a conducive ecosystem and a strong supply chain for the footwear manufacturing industry.

**Policy to focus on leather as well as non-leather industry in TN**

Instead of focusing only on the leather footwear industry, the policy opted for a wider scope of employment generation by enhancing the non-leather footwear and component ecosystem.

To achieve this, it will support the ancillary units besides encouraging exports.

Due to this, other associated industries will be eligible for certain subsidies in the coming time. Industries allied to footwear manufacturing or component industries located outside the clusters are eligible for a Fixed Capital Subsidy (FCS) of 10 percent of investment in eligible fixed assets to be disbursed in 10 equal annual instalments.

Companies can avail of this subsidy by showing their eligibility in terms of the scale of production, investment, or the number of employments it generates. The minimum eligible investment threshold for the companies is ₹150 crore and the minimum employment threshold is 100 jobs.

*(MINT – 23/08/2022)*

## RLSD 2022 DESIGN COMPETITION FINALISTS ANNOUNCED

The global finalists have been announced for the Real Leather. Stay Different. (RLSD) International Student Design Competition 2022. More than 130 academic institutions across 40 countries were represented as students competed for the categories of Apparel, Footwear, Accessories and People's Choice.

The four finalists will compete head-to-head in a live final in London on September 15, 2022, in front of a judging panel of leading fashion industry experts.

The judging panel is comprised of:

- Christopher Koerber, Managing Director, HUGO BOSS
- Rosie Wollacott Phillips, Head of Sustainability, Mulberry
- Mike Adler, Style & Fashion Director
- Leanne Elliott Young and Cattytay, Co-Founders, Institute of Digital Fashion
- Emily Omesi, FIT NYC graduate and the 2021 International winner

The finalist for the Apparel category is Gal Benjamin from Shenkar College of Engineering, Design and Art, Israel, for Alexithymia (trousers). Benjamin is a 24-year-old designer currently based in Israel, who specialises in menswear atelier, pattern cutting, and gender-neutral/mixed FM fashion.

His designs are made using advanced pattern cutting and sewing techniques in leather, emphasising zero waste techniques as well as items designed with consideration and sewn fully from leather leftovers.

The finalist for the Footwear category is Anna Melegh from London College of Fashion, UAL, for Haute Couture Trash (shoes). Melegh is a footwear and accessories designer turning everyday objects inside out by using the methods of surrealism.

She has worked with leather, footwear and accessories for more than eight years now and has gained knowledge from various industry professionals. She has visited trade fairs such as Lineapelle, Premiere Vision, and built connections within the industry with companies in Brazil, India, UK, Italy, Netherlands, Iceland and Hungary. She is also the Overall Winner for the 2022 Real Leather. Stay Different UK National Competition.

The finalist for the Accessories category is Gianluca Ambrosini from SCAD Savannah in the U.S. for Pouch Shopping Bag (bag). Ambrosini is a Peruvian accessory designer with a B.F.A in Industrial Design at the Savannah College of Art and Design (SCAD), and is currently based in Georgia, getting an M.F.A in Accessory Design, specialising in handbags.

His approach to design is rooted in storytelling, creating interesting and tongue-in-cheek designs that start a conversation. Having worked at Coach as an apprentice for a year, he tries to strike a balance between innovation and commerciality, creating products that allow a wide range of customers to express themselves.

The finalist for the fourth category, the People's Choice, is Lior Weinberg, also from Shenkar College of Engineering, Design and Art, Israel, for Paradox of Fashion (leather jacket). Weinberg is a 24-year-old third-year fashion design student at Shenkar

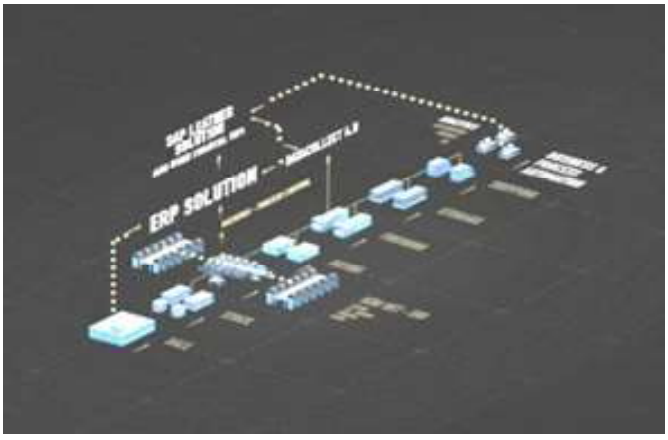
College of engineering and design in Israel. She specialises in apparel, womenswear, lingerie and swimwear. Her work examines dress codes and uniforms over the years, and the paradox that fashion creates in our need to imitate others but also distinguish ourselves from each other.

Rosie Wollacott Phillips, Head of Sustainability at Mulberry, said: "It was an unbelievably challenging task for everyone involved in the selection and judging process to identify the category winners, such was the quality, diversity and sheer volume of entries. "But we did so independently with the People's Choice vote ensuring broad consensus for our fourth finalist. I am deeply encouraged by what I have seen. Creativity is alive and well – and there is a real appetite in these young designers to explore how they can incorporate leather into their work.

"Leather is a beautiful and sustainable material when sourced properly. I'm delighted to be supporting tomorrow's generation of design talent, who take sustainability seriously, to reconsider their relationship with leather and other natural materials in order to create stunning designs where longevity and minimal environmental impact is key. I am looking forward to meeting these designers in person for the global final that will decide the overall winner."

*(ILM – 23/08/2022)*

## DIGITAL TRANSFORMATION, A PROCESS OF TRANSFORMATION – DIGITALIZATION IN TANNERY BUSINESS: N. JACOBSEN, HEAD OF DIGITALIZATION AT HÜNI GROUP/SALES MANAGER




The major challenge is selecting the right technologies and solutions that would bring the most benefits at low risk. Hüni assists their customers in AGILE methodology, seeking quick wins from day 1 to encourage the high-level management until the highest operation level believes in the transformation process. It is a correct approach to inspire growth in company culture. By splitting the project into smaller elements, and delivering solid results with reduced efforts, we add value to the operation.

This transformation process consists of tools and resources such as ERP solutions, Data-Driven Culture, Data Analytics, Business Process Automation, Artificial Intelligence, Leather and Chemical Traceability, RFID, Digitalization of process, Machine connection, IoT and Big data. Hüni experts are involved in evaluating the process to define the opportunities for innovation.


All data stored on paper is hard to track and evaluate to create insights, which is the reason behind the importance of the data in a digital form. Connection to machines increases control without increasing demand for more workers. These are all examples of how to speed up the process and improve performance.

The project scope is tailor-made for the customer to fit value perception, market strategy, and daily challenges in the tannery. Understanding where the company stands and which goals it wants to achieve, everything needs to be assessed to create value for the company and implement high-impact cases.

Engagement of all stakeholders on the commitment to the project, increasing productivity for the operation level, and supporting decision-makers to take the decisions based on data. The goal is to find several small improvements which will lead to greater transformations.

*(LeatherMag.com – 11/08/2022)*

*This article was originaly published in Vol.- 33 No.- 07 July' 1989 issue of JILTA.*

SCIENCE AND TECHNOLOGY

# Basis for Instrumental Colour Measurement and Matching

*By*

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I. C. I. India Ltd. Rishra, Hooghly

( *Continued from July 1989 issue* )

## 7. INSTRUMENTAL COLOUR MATCHING

Having briefly dealt about the colour measurement in the previous issue, we shall go into the more applied field how with the help of the colour values we can predict the proportion of the given colourants to match a given sample or standard as closely as possible *i.e.*, $\Delta E$ minimum.

The figure no. 20 shows an assembly of the instruments. A spectrophotometer giving the % reflectance value at each 16 wave lengths ranging from 400 n.m. to 700 n.m. at 20 n.m. interval. A microprocessor attached to a video screen which calculates the source dependant CIE. X, Y, Z values and from them L, a, b values. It also shows graphically position of given colour in L, a, b 3-D plot as well as % reflectance vs wave length graph. (If wanted, it calculates in differences of colour values between two coloured substances designated as $\Delta$ L, $\Delta$ a $\Delta$ b and $\Delta$ E). These two are interconnected. Finally they are connected to a computer and a recorder which makes all the calculations regarding formulation and analysis of costing, coverage in terms of $ft^2$/lit or $m^2$/lit etc.

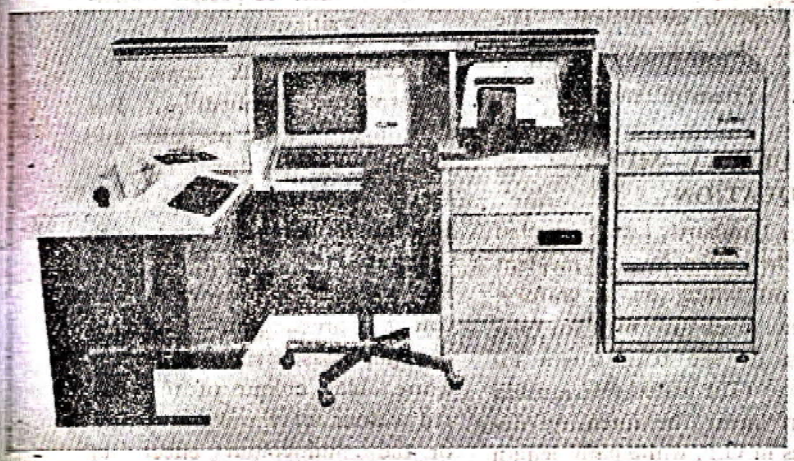


Fig. 20. Assembly of instruments needed for colour value analysis and colour matching. Showing from right CPU, Spectrophotometer Personal Computer IBM PC/XT (or PC/AT family), Printer

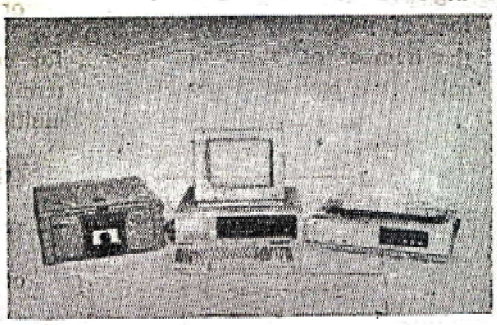


Fig. 21. Assembly of instruments Spectrophotometer, computer with VDU and printer — assembly of instruments needed for colour matching (Computer-aided)

Figure no. 21, showing assembly of instruments from right to left—spectrophotometer, P. C. with video screen for display of results, graphs etc., with recorder attachments.

Before we go inside the method of calculation, its basis has to be understood. Firstly we shall discuss derive the two fundamental laws : (1) Beer—Lambart's Law and (2) Kubelka —Munk equation.

## 8. BEER—LAMBART'S LAW

This is very important law in absorption spectroscopy for doing quantitative analysis.

Let us consider a glass cuvet with plane parallel faces traversed by a monochromatic E.M. radiation. If the cuvet is filled up with absorbing molecules dissolved in non-absorbing solvents the radiation diminishes in power the further the radiation penetrates inside the solution—(neglecting the loss of power due to reflection from the surface of the cuvet) and also further the concentration of the solute (absorbing species). More genrally the loss of power is proportional to the number of absorbing molecules in the path of the beam.

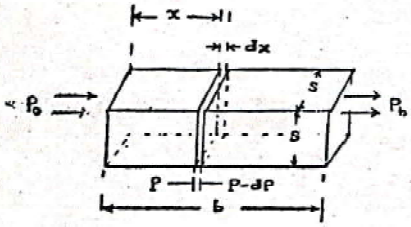



Fig 22. Glass cuvet traversed by a monochromatic electromagnetic radiation with incident power $P_o$ and transmitted power $P_b$

The successive increments in the number of identical absorbing molecules in the path of a monochromatic radiation absorbs equal fraction of the radiation power traversing them.

According to figure no. 22, the number of absorbing molecules in the volume $S^2b$ is $NCS^2dx$ (where N = Avogrado's number and C = concn. in moles per liter).

Hence Beer's Law can be expressed as :

$$\frac{d\,P}{NCS^2\,dx} = -KP$$

(where K = proportionality constant)

K represents the fraction of the power P that is absorbed in the distance dx. By merging N into the constant and considering a unit cross section we get

$$\frac{d\,p}{p} = -KC\,dx$$

[$\because S^2 = 1$ by precondition]

integrating over the path length b we get,

$$\int_{Po}^{Pb} \frac{1}{P}\,P = -KC\int_{o}^{b} dx$$

$$\text{or } \ln \frac{Pb}{Po} = -KCb$$

for convenience we can write in terms of common logerithm by multiplying both side with 2.303.

$$\log 10\,\frac{Pb}{Po} = -abc$$

where a = new constant

$$\text{or } \log 10\,\frac{Po}{Pb} = abc$$

[for removing negative sign we may invert the logerithm factor.]

$\text{Log } 10\,\frac{Po}{Pb}$ is known as absorbance and the factor K is called as absorption co-efficient. The product abc is known as Absorbance. Triansmittance $= \frac{Pb}{Po}$.

## 9. KUBELKA—MUNK EQUATION

Beer Lambart's Law suggested that the intensity of incident radiation falling on an uniform and homogenous medium decreases as the path length increases. (The actual relationship is non linear the intensity decreases in G.P. while path length increases in A. P.—the mathematical representation of this statement is $\log 10\frac{Pb}{Po} = a'b$ where a' is constant and when concentration is also constant).

In 1905 following this useful statement which was due to Lambart the two astrophysicist Kubelka and Munk wanted to derive an equation explaining the reduction of power of radiation from the stars in space while reaching the earth ; in terms of their reflectance or transmittance. This very useful equation was eventually turned as a foundation law for explaining optics of a colourant layer.

Radiant power is proportional to the number of photon emitted per second and hence proportional to its intensity (vide table 1). So we may recall

$$T = \frac{Pb}{Po} \equiv \frac{I}{Io} = R \text{ (or } \sigma)$$

where T = transmittance

Pb = power of the emergent beam,

Po = power of the incident beam, Ib and Io are their respective intensities.

Kubelka Munk considered atmosphere as the medium. But it contains dust particles and organic vapours which has the chrompophoric groups and hence absorption and scattering both simultaneously operates (both the properties can contribute colour production.—Scattering of light causes snow to appear white, blue colour of the sky, red colour of the sky at sunrise or the multicolour effect of the peacock features). Hence he has taken the two terms absorption co-efficient from Beer's Law and scattering

coefficient (Raleigh's scattering phenomenon) designated as $K_\lambda$ and $S_\lambda$ respectively since both these constants the dependent on the wave length of the incident radiation.

Kubelka—Munk assumed diffused light within a film of infinite area but finite thickness and the dust particles etc. are distributed in it homogenously. They considered what happens to the diffused light when transmitted through the layer dx, some is absorbed some is returned towards the surface owing to scattering. The light that eventually reaches the surface of the substrate is reflected upwards in a proportion to the reflectance of the substrate and undergoes further absorption and scattering.

As per the following figure no. 23 if we consider the intensity of radiant beam incidented from top normally to the surface of the film as i and the light returning upward also at normal to the surface of the film, either from scattering at the thin layer or by reflecting from the surface has an intensity = j then the light going sideway was neglected by them since the film is infinite in this direction so that light ray in this direction is either a part of i or j.

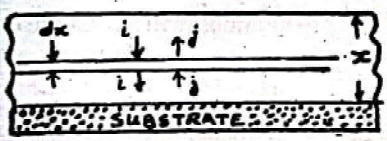



Fig 23. Effect of absorption and scattering on coating film.

Then by definition reflectance of the film in question is $j/i = \sigma$ let's say.

considering only i the reduction in intensity of i is due to

1) absorption = $-Kidx$

2) scattering = $-Sidx$

and considering j the reduction in intensity of j is due to

3) absorption = $-Kjdx$

4) scattering = $-Sjdx$

The extreme effect of scattering as considered by them, is the reversal of the direction of radiation. Hence that fraction of the radiation which is removed from the descending radiation by scattering will be added to the intensity of opposite direction. Hence considering i the net reduction in intensity

$$-di = -Kidx - Sidx + Sjdx \quad \ldots (1)$$

and similarly for j this is —

$$dj = Kjdx + Sjdx - Sidx \quad \ldots (2)$$

[opposite vector hence the sign is reversed.]

Now by dividing equation no. (1) by Sidx we get,

$$-\frac{1}{Si}\frac{di}{dx} = \frac{Kidx}{Sidx} - \frac{Sidx}{Sidx} + \frac{Sjdx}{Sidx}$$

$$= -\left(\frac{K}{S}+1\right) + j/i$$

$$= -(K/S+1) + \sigma$$

$[\because \sigma = j/i$ by definition] $\quad \ldots (3)$

Similarly by dividing equation no. (2) by Sjdx we get,

$$\frac{1}{Sj}\frac{dj}{dx} = \frac{Kjdx}{Sjdx} + \frac{Sjdx}{Sjdx} - \frac{Sidx}{Sjdx}$$

$$= (K/S+1) - \frac{1}{j/i}$$

$$= (K/S+1) - \frac{1}{\sigma} \quad \ldots (4)$$

$[\because j/i = \sigma]$

Kubelka and Munk brought a significant concept of complete opaque film here. They considered the reflectance at an infinitely thick film such that no light can reach the surface ever (fully covered paint film or pigmented finish at full opacity). Then from this thickness and beyond this, no further change in the intensity of radiation is possible. If we consider reflectance at this point as $R_\infty$ instead of $\sigma$, then at this point equation (3) becomes equal to equation (4)

or $-(K/S+1) + R_\infty$

$$= (K/S+1) - \frac{1}{R_\infty}$$

(by substituting $\sigma$ by $R_\infty$

or $-1 - K/S + R_\infty$

$$= K/S + 1 - \frac{1}{R_\infty}$$

or $2\,K/S = -2 + R_\infty + \frac{1}{R_\infty}$

$$= \frac{-2R_\infty + 1 + R_\infty^2}{R}$$

$$= \frac{(1-R_\infty)^2}{R_\infty)}$$

Hence $K/S = \frac{(1-R_\infty)^2}{2R_\infty}$

This is the famous Kubelka—Munk equation, Since both K & S values dependent on $\lambda$, $R_\infty$ is also dependent on $\lambda$

So $K_\lambda/S_\lambda = \frac{(1-R_\infty)^2}{2R_\infty}$

This equation has got a tremendous qualitative and quantitative sign ficance and all colour programme are based on this theory.

K-M the ry makes a number of assumption for the sake of simplicity, which can contribute to the errors in non-ideal situations. It assumes illumination and viewing to be diffused without polarization of light. It

further assumes a plane parallel surface, without light losses at the edges. The film was assumed to be uniform in composition and property which is far away from the normal surface coating films. Therefore, it does not account for the presence of the large particles, agglomarates or a particular orientation of the particle and its shape. This theory also assumes optical contacts with the next layer (which is not true when hiding is accomplished by repeated coating and intermediate drying or plating) or in otherwords no change in refractive index between each successive layer. They also assumed particles to be large when compared to the wave length of the light but small when compared to film thickness.

Since it is assumed that, there is no change in refractive index (changes in R.I. is the loci for scattering) at the surface of the film, the K-M equation is valdi only for the light scattered back from the interior of the film. A certain amount of light must have been reflected at the film surface as a result of the differences in R.I. between the air and the film. This component is expressed as specular reflection which gives rise to the gloss of the film, this is a kind of external reflection. Although it is possible to eliminate perfectly glossy sample, but more reproducible data are obtained by performing measurement of gloss included and applying computational correction.

There is also an internal reflection as the light passess through medium of higher R.I. towards air. (The light may get reflected at and beyond its critical incident angle—the well known phenomenon for explaining formation of mirrage in a desert).

These two forms of specular or external and internal reflection from the film has been exemplified pictorially in the following diagram (vide figure no. 24).

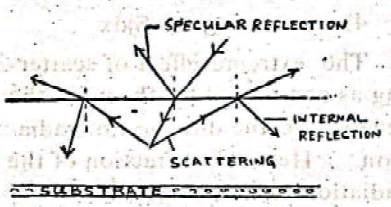



Fig. 24. Showing specular reflection, internal reflection and scattering etc. of an incident beam inside and outside the coating film surface.

For surface coating an equation referred to as the Sunderson's correction is used to make correction for this internal and external reflection.

Sunderson's Equation :

$$R = (R' - K_1) / [(1 - K_1)(1 - K_2) + K_2 R' - K_1 K_2]$$

where R = true reflectance of the film at a specific wave length as a fraction of 1.

R' = Measured reflectance of the film at a specific wave length as a fraction of 1.

$K_1$ = External (specular) reflectance constant = 0.54

$K_2$ = Internal reflectance constant = 0.04

## 10. COLOUR MATCHING PROCEDURE

The qualitative aspect of K.M. equation makes us understand qualitatively the colour matching problems and quantitative aspect of Kubelka Munk equation leads us to predict the proportions of concentration with which the number of given colourants in a factory to be mixed to match an unknown or target colour.

Now due to the complicacy of the mathematical calculations the computer here can ease the operation with much greater accuracy. The steps involved for preparatory work for colour match prediction are as follows :

Step 1. Calibration of spectrophotometer with the standard white tiles every day before starting any colour formulation programme or colour measurement programme.

Step 2. Storing in computer memory the optical constants at each wave length (*viz.* 400, 420, 440, .... 700 n.m.) with respect to white season, which will be considered by the user as standard white base.

Step 3. Storing in computer memory the optical constants at each wave length which will be

considered as standard black, since logically white will have highest reflectance and black least, the reflectance of any coloured substance will be in between this extreme points.

Hence if the

TW, MW be the true and measured reflectance for white

TB, MB be the true and measured reflectance for black

TS, MS be the true, and measured reflectance for any coloured sample.

Then we can calculate the true reflectance of coloured sample TS from the other five known values by applying simple interpolation techniques of statistics as :

TB MB the lowest value
TS MS intermidate value
TW MW highest value

hence $\frac{TS-TB}{TW-TB} = \frac{MS-MB}{MW-MB}$

or $TS-TB = \frac{(MS-MB)\ (TW-TB)}{(MW-MB)}$

or $TS = [(MS-MB)\ (TW-TB)\ /\ (MW-MB)] + TB$

hence the other five values are known the true reflectance of the coloured sample at each wave length can be corrected having measured the reflectance value by the spectrophotometer.

Step 3.1. It is meant for checking the strength of all coloured pigment samples which the factory will be using to match any colour.

The procedure is to take 100 gms of standard white and to inject in it with self disposible syringe and flanger a known and prefixed concn. of 2 ml coloured pigment dispersion. Stir in a mechanical stirrer. Add other ingredients as per standard formulation and prepare a panel by applying the season as per real condition. Dry.

The panel will have a sticker containing a square of black colour and a square of white colour before the season is applied. Now on applying season we will have to see that the black and white portion should look like same. The colour values at those two squares are determined the $\Delta E < 0.1$ will signify the opacity or tinting strength of the pigment. ($\Delta E$ with respect to the total colour difference between the blocks).

The reflectance values at these opacity for each pigment base at each wave length are stored individually. Purpose is to compare the future supply of pigments by comparing with this data from the measured, value of the fresh lot for standardizing and controlling the quality of the fresh pigment batches.

Step 4. Generation of K and S data of each pigment at each wave length, This step is eventually based on 4 sub steps.

Step 4.1. It is preferred to convert the pigment pasts to standard season by mixing with required amount of resin, binder and other ingredients for analysis and generation of K and S data.

Step 4.2. Mix a standard white season with the coloured pigment season (each pigment individually one after another) in the proportion as exemplified in the following table. The same exercise has to be done for each type of pigments. That is for each pigments 10 different mixture of colour has to be produced.

TABLE—12

**Reduction of a Coloured Pigment Season with Standard White Season**

| Season designation | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| Standard white season in parts | 0.5 | 1.0 | 2.5 | 5·0 | 10.0 | 25.0 | 50 0 | 75.0 | 98.0 | 100.0 |
| Coloured pigment season in parts | 99.5 | 99.0 | 97.5 | 95.0 | 90.0 | 75.0 | 50 0 | 25.0 | 2.0 | 0.0 |
| To·al parts | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

All the pigments has to be made into season in the similar manner.

Step 4.3. Prepare panels at full opacity with each of the above mentioned 10 seasons (A to J) for each colour considering actual application condition. Hiding must be complete.

Step 4.4. From the concept of K-M. theory the reflectance value of each panels at each wave length will be thus the $R\lambda$ value of that particular pigment season in that wave length. This can be converted to $K_\lambda / S_\lambda$ ratio using K – M equation

$= K_\lambda/S_\lambda = (1-R\lambda)^2/2R\lambda$

Now at full opacity K and S values are treated seperately as an additive function of C, the concentration. In other words the absorption co-efficient K and scattering co-efficient S of a coating film are taken to be the concentration weighted sum of the K and S values of the constituents in the system.

Precisely if a colourant is made with the addition of 4 pigments namely A, B, C, D in the concn. $C_a$, $C_b$, $C_c$ and $C_d$ respsctively. If they have K values at a particular wave length as Ka, Kb, Kc and Kd and corresponding S values as Sa, Sb, Sc and Sd. Then the resultant K and S value at each wave length of their mixture will obey the following two addition equations.

$$K = CaKa + CbKb + CcKc + CdKd \quad \text{.... (1)}$$

$$S = CaSa + CbSb + CcSc + CdSd \quad \text{.... (2)}$$

Determination of K and S values of any coloured pigment are done one wave length at a time. Since the total parts of the panels prepared after mixing with white are same in all the case we can convert it with respect to unity.

For each panel A, B, C, D .... J as in table-12

we can re-write the equation (i) & (ii) as :

$$K = C K_T + (1-C) KW \quad \text{.... (3)}$$

and $S = C S_T + (1-C) SW$ .... (4)

at each wave length,

where C = concn. of the coloured pigment when the total season is 1 part and $K_T$ and $S_T$ are the absoprtion and scattering constant at that particular wave length of the coloured pigment. KW and SW are the absorption and the scattering constant at that wave length of standard white. We have already generated vide step 2 the $R\lambda$ value at each wave length for white and from that KW/SW can be known SW at all wave length are assumed to be i hence $KW = R\lambda$ corrected for true reflectance using Sunderson's correction equation.

From the measured reflectance of the c loured pigment the true reflectance can be obtained using formulation.

The scattering constant (SW) of the standard white is usually assumed to be one as mentioned. Absorption co-efficient of white can be measured by measuring white alone (vide step 2), calculating corresponding K/S at each wave length from R value using K-M equation is already programmed and stored in the memory. Since we assume SW = 1, KW becomes equal to $(1-R)^2/2R$

Equation 7 has now two unknown KT and ST the absorption and scattering constant of the coloured pigment at each wave length, everything else are known. Since the measurement are subject to error more than two points are measured to derive two equation so as to solve these two unknown. Hence by this technique we can get K and S value of all the coloured pigment at each wave length.

A linear least square regression analysis is performed on data, which derives the value of the two constant KT and ST giving the best line to the graph of concentration vs wave length at a particular wave length.

Fig 25. on facing page

$$R = TS = \{[(MS-MB)\ (TW-TB)] / (MW-MB)\} + TB$$

This true reflectance R at a particular wave length is used to get $K_\lambda/S_\lambda$ value.

Now from equation—(3) and (4) we can write

$$[C \times KT + (1-C)]KW\ /\ [C \times ST + (1-C)\ SW] = K/S$$

multiplying through the denominator and by rearranging we get,

$$C \times KT - C\ (K/S)\ ST = (1-C) \times (K/S)\ SW - KW \quad \text{.... (5)}$$

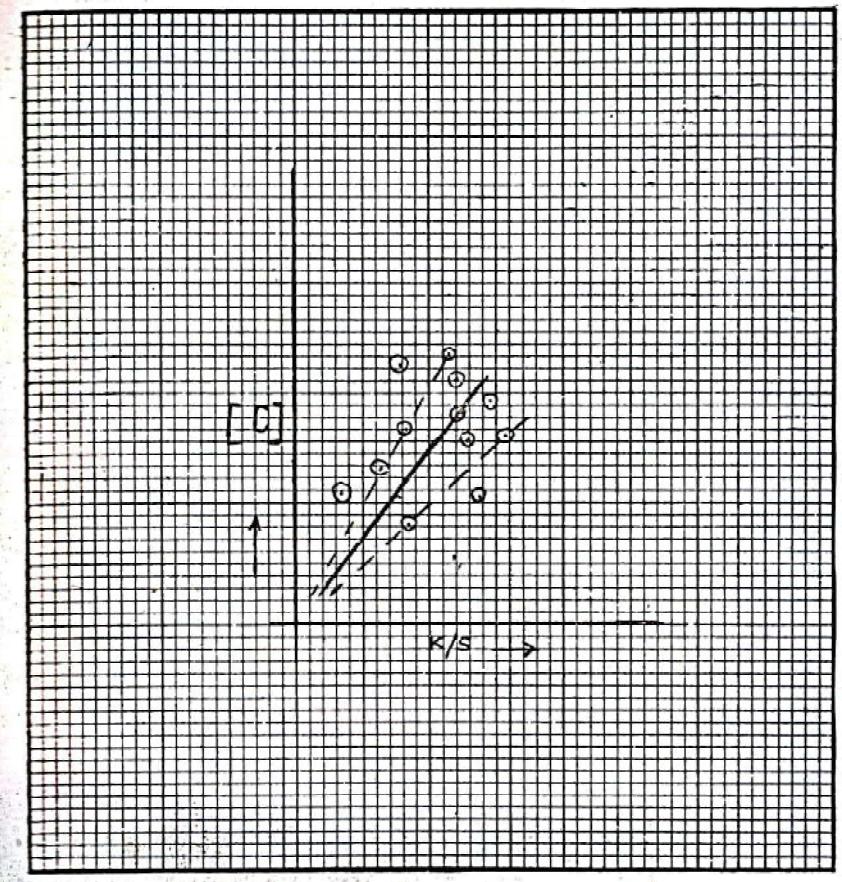



Fig. 25 : Curve fitting by least square regression analysis.

The two dotted lines represent here two possible solution, if only two concentrations are considered, where as the solid line represent a better solution derived by a least square (linear) regression analysis (which is a statistical device to obtain a best fitting curve from a given set of co-ordinates) of a number of concentration. In this way the best K and S values at each wave length of each pigments are generated and stored in the computer memory.

Example :

The principles of least square regression analysis has been described in any text book of statistics. Supposing we want to derive an equation for a best fitting straight line ($Y = a + bx$) from a given set of observation illustrated in the following table no. 13 where the independent variable is the K/S value) in x axis) and dependent variable are C, concentration (y axis)' are measured, let's say in 7 panels designated as A, B, C ....G (vide table—12).

TABLE—13

**K/S and (C) relationship of 7 panels of single pigment**

| Panel designation | K/S Value (x) | (C) Value y = f (x) |
|---|---|---|
| A | 10 | 19 |
| B | 12 | 22 |
| C | 13 | 24 |
| D | 16 | 27 |
| E | 17 | 29 |
| F | 20 | 33 |
| G | 25 | 37 |

We shall now apply linear least square regression analysis to obtain a best fitting curve to be drawn as solid line in the graph (vide figure no. 25) having general equation $y = a + bx$.

TABLE—14

**Least square regression analysis**

| Designation of panels | K/S (x) | (C) (y) | $(K/S)^2$ ($x^2$) | K/S × (C) (xy) |
|---|---|---|---|---|
| A | 10 | 19 | 100 | 190 |
| B | 12 | 22 | 144 | 264 |
| C | 13 | 24 | 169 | 312 |
| D | 16 | 27 | 256 | 432 |
| E | 17 | 29 | 289 | 493 |
| F | 20 | 33 | 400 | 660 |
| G | 25 | 37 | 625 | 925 |
| Total | 113 | 191 | 1983 | 3276 |

Hence N = 7 (A to G) $\Sigma y = 191$, $\Sigma x = 113$

$\Sigma x^2 = 1983$ and $\Sigma xy = 3276$

By putting these values is least square regression formula for straight line.

$$\Sigma y = an + b \Sigma x \quad \text{.... (1)}$$

and

$$\Sigma xy = a \Sigma x + b \Sigma x^2 \quad \text{.... (2)}$$

we get, $191 = 7a + 113b$ .... (3)

and

$3276 = 113a + 1983b$ .... (4)

equating these two equation (3) and (4) we get

$a = 7.75$ and $b = 1.21$

hence the best fitting straight line will have the equation

$y = a + bx$ or $y = 7.75 + 1.21$.

having a slope with respect of x axis = $\tan^{-1}$ 1.21° and interest for y axis = 7.75. So the solid line can be drawn. The iine found passing through the (x, y) already plotted, then the K/S value of that point *i.e.*, the x value of that point is considered as best K/S ratio of that pigment at that particular wave length. Hence its K and S value at that wave length will represent also the best K and S value at the corresponding wave length. Hence K' and S value of all the pigments at all 16 wave lengths in visible spectrum and their corresponding concentration values are stored and generated in the computer memory.

The criticism of this technique is also to be noted as in practice it has been observed by that for the colours that require employment of higher concentration of constituent pigment to match certain shade the prediction is not found very accurate.

The reason as we feel is that the entire colour formulation is based on additive function K-M equation hence the generation of correct K and S value at correct (c) is of extreme importance.

Here by least square regression analysis we assumed a straight line representing the best fiiting line. But experimental evidence by plotting (c) vs K/S shows that there is a deviation from the linear relationship at higher concentrat (vide figure no. 26). Hence at higher concentration the prediction of formulation with respect to the relative concentration deviates from accuracy (vide figure no. 26).

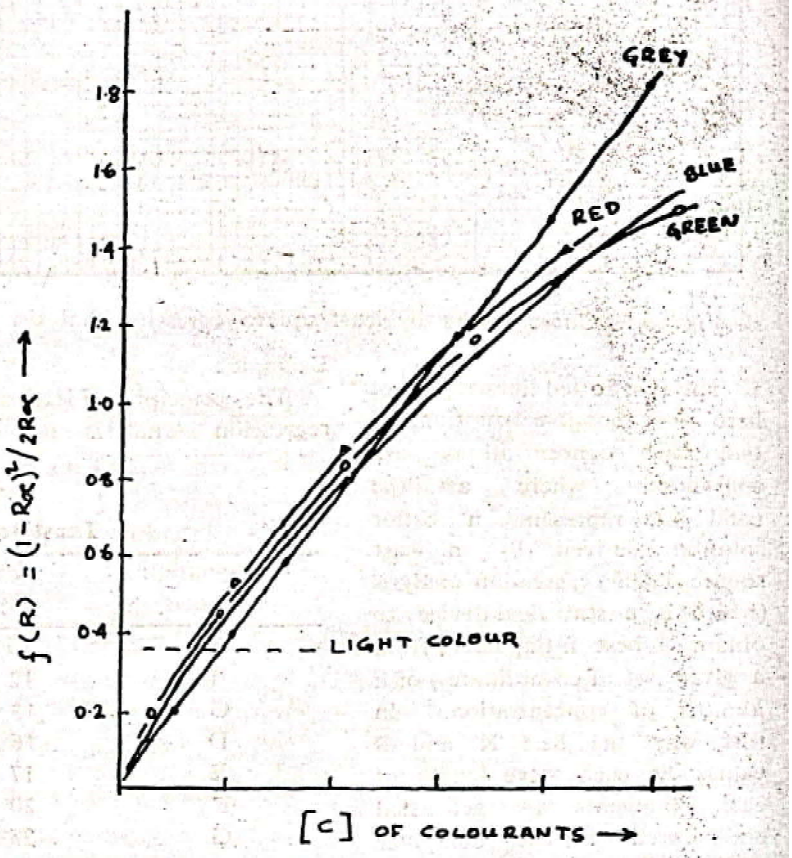



Fig. 26. The deviation from linearity at higher concentration. K/S and [C] relation ship.

Instead log (C) vs log (K/S) shows more linear relationships irresespective and indepedent of concentration range. The corresponding [C] and [K/S] value of the best fitting straight line by doing least square regression analysis from the log K/S vs log [C] data (and finally performing antilog) seemed to produce better accuracy (vide figure no. 27).

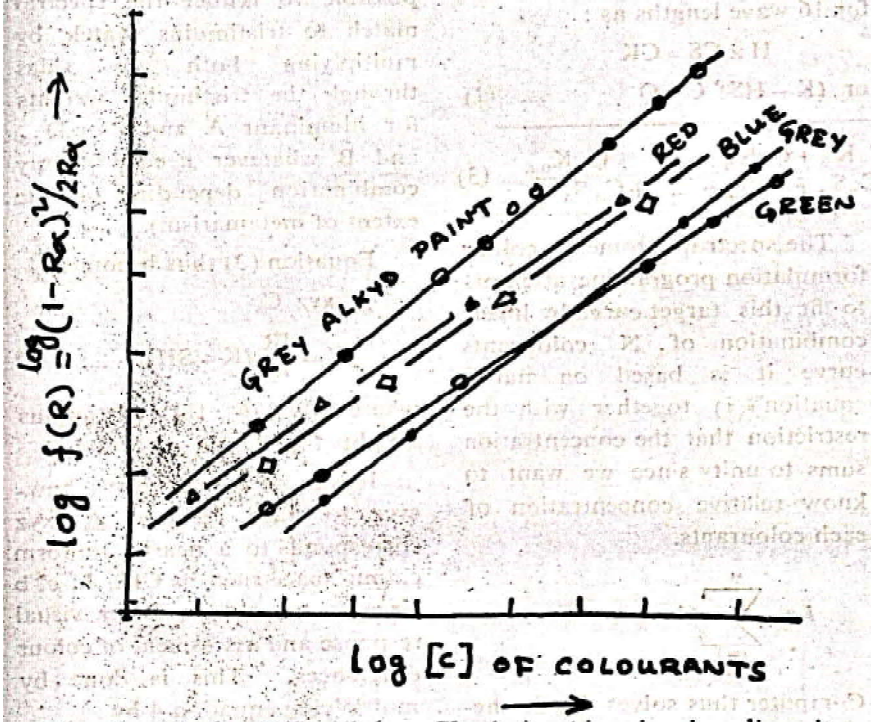



Fig. 27. The log K/S and log [C] relationship showing linearity at the entire range.

When we go for colour matching of a given sample we should consider it as standard. Then we first measure its values in terms of L, a, and b values—more significantly its % reflectance at all the 16 wave lengths (400, 420, 440 .... 700) with the help of spectrophotometer. Let us consider it as a graph similar to that has been shown with respect to a colour 6-071 ploting % reflectance vs wave length (vide figure no. 16).

Now the main object would be the with pigments that has been analysed and the basic data of which has been generated with respect to their K and S value at each wave length and the concentration, with those pigments in certain unknown proportion of concentration if we can simulate the % reflectance vs wave length pattern same as that of the standard then logically those relative concentration mixture of the known pigments should originate the same spectral response as that of the standard or we can say a perfect spectral match have been accomplished.

The entire principles and mathemetical calculations for colour matching is aimed to this principle. That is to simulate the same (or similar) reflection pattern at each wave length of the standard whose composition is unknown with the help of the combination of known and existing pigments.

Manually this is practiced by trial and error methods and instrumentally it is done by mathematical calculations based on the theories described in this article.

Now from the analysis or measurement of the standard in the spectrophotometer we can know the reflectance at each wave length. This reflectance value are corrected applying Sunderson's correction equation which takes into account the specular reflection as well as internal reflection. Now provided the standard is opaque (*i.e.*, pigmented to cover up the surface) from this true reflection value it is possible to generate K/S data of the standard at each wave length. This is the target for achievement. With the combination of known pigments if we can find out the relative concentration of them so that their resultant K/S value (which is a concentration weighted sum of their respective K and S value at each wave length) is same as that of the target then we know the relative concentration.

Now the standard will be measured for all the 16 wave length so we get 16 target K/S values to match.

As we have already seen the absorption co-efficient K and the

scattering co-efficient S of an opaque film is taken to be the concentration weighted sum of the K and S values of the constituting colourants of the system

So

$$K = C_1K_1 + C_2K_2 + C_3K_3 \ldots\ldots (1)$$

and

$$S = C_1S_1 + C_2S_2 + C_3S_3 \ldots\ldots (2)$$

In order to have a spectrophotometric match at all the 16 wave lengths for a coloured surface coating containing N colourants the following equation must hold good at each of the 16 wave length.

$$\frac{(1-R)^2}{2R} = \theta \neq \frac{K}{S} = \frac{C_1K_1 + C_2K_2 + C_3K_3 + \ldots + C_nK_n}{C_1S_1 + C_2S_2 + C_3S_3 + \ldots + C_nS_n} \ldots\ldots (3)$$

Hence we get 16 such equation whose $K_1$, $K_2$, $K_3$ .... $K_n$ values $S_1$, $S_2$, $S_3$ .... $S_n$ values K/S value of the standard are known. Only the proportion *i.e.*, $C_1 : C_2 : C_3 \ldots : C_n$ has to be worked out.

Now this complicated solution can be done in a minute by a computer using matrice method (reference may be made to any text book on higher algebra).

If we define the following matrices such that

1) K (16 × N) = 16 absorption co-efficient of N colourants designated as $K_1$, $K_2$, $K_3$ .... $K_n$ at each 16 wave length which is known.

2) S (16 × N) = 16 scattering co-efficient of N colourants designated as $S_1$, $S_2$, $S_3$ .... $S_n$ at each 16 wave lengths which is also known.

3) C (N × 1) = Relative concentration of N colourants — unknown.

4) diagonally H (16 × 16) = Kubelka — Munk function of target reflectance.

The previous equation base on additive principles can be stated in usual matrix notation for 16 wave lengths as :

$$H \times CS = CK$$

or $$(K - HS)\, C = O \ldots\ldots (1)$$

The spectrophotometric colour formulation programme attempts to fit this target curve by linear combination of N colourants curve it is based on matrix equation (1) together with the restriction that the concentration sums to unity since we want to know relative concentration of each colourants.

$$i.e., \sum_{i=1}^{N} C = 1$$

Computer thus solves the mathematical problem in this way and let us know the concentration of each N no. of colourants required to give the match of colour of the standard.

The differences between the formulation and the target function can be expressed as

$$\Delta\theta = \frac{CK}{CS} - H \text{ (target)}$$ where

[$\Delta\theta$ = residual reflectance]

or $$\Delta\theta CS = C\,(K - SH) \ldots\ldots (2)$$

In case we want a better match we would have target and the reflectance curves as close as possible ; or logically we can multiply equation (2) by $\frac{dR}{d\theta}$ to convert residual $\Delta\theta$ to $\Delta R$. So equation (2) becomes

$$\Delta\, RCS = \frac{dR}{d}(K - SH)\, C \ldots (3)$$

Now mathematically it is possible to reduce the spectral match to tristimulus match by multiplying both the sides through the tristimulus weights for illuminant A and C or $D_{65}$ and B whatever needed (or any combination depending on the extent of metamarism).

Equation (3) thus becomes

$$\Delta\, xyz\; C_s$$

$$W = \frac{dR}{d\theta}(K - SH)C \ldots\ldots (4)$$

where W (6 × 16) = tristimulus weights for illuminant A and C.

It is more advantageous however to have residual $\Delta$ xyz corresponds to a nearly uniform colour space such as CIE, L, a, b since it narrates a faster visual response and assessment of colour differences. This is done by multiplying equation 4 by

$$\frac{d\, L\, a\, b}{d\, x\, y\, z}$$

$$\therefore \quad \Delta L\, a\, b\, C_s = \frac{d\, L\, a\, b}{d\, x\, y\, z} W \frac{dR}{d\theta}(K - SH)C \ldots\ldots (5)$$

By defining Q = (16 × 16) = diagonal matrix containing $\frac{dR}{d\theta}$ of apparent reflectance.

D = (3, 3) = derivatives of $\frac{dLab}{dxyz}$

equation 5 using matrix notation becomes—

$$\Delta L\ a\ b\ C_s = DWQ\ (K-SH)\ C \quad \ldots (6)$$

For a perfect match L a b must be 0. (Zero). Hence the equation (6) becomes

$$DWQ\ (K-SH)\ C = 0 \qquad (7)$$

which uses linear restriction such that,

$$\sum_{i=1}^{N} ci = 1$$

It is the system of psendo-linear equation solved eventually by the standard linear programming algorithms.

We shall project here a computer print out describing colour matching of a colour x as a sort of case study for the reader.

Hence in a brief the steps can be summerized and a flow chart of work may be displayed principally as per figure no. 28.

Next figure shows reflectance patterns of a standard and the sample matched. This shows not exactly a 100% match but the position of ups and downs of the curve suggests that the match is metameric. That it will give a same stimulation in only one environment.

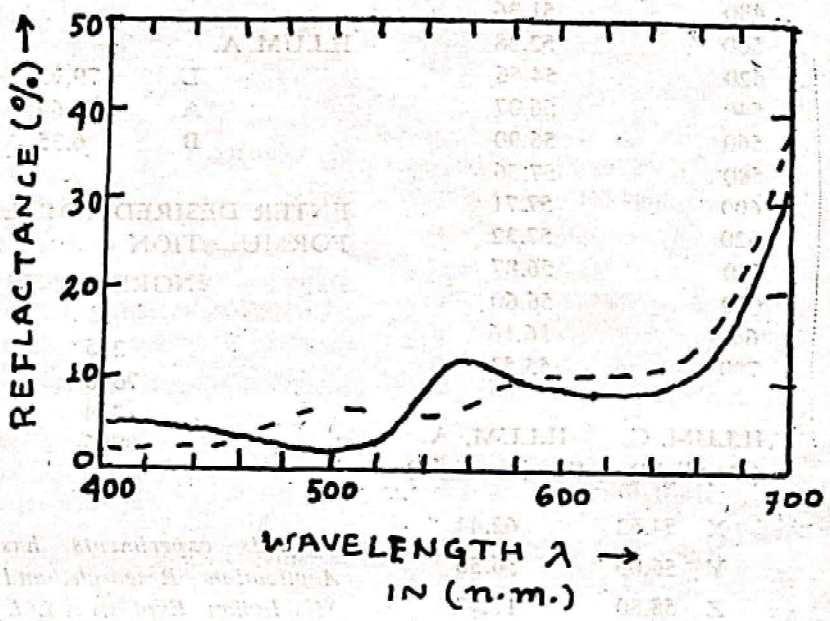



Fig 29. Metameric match of terget curve with attempted curve.

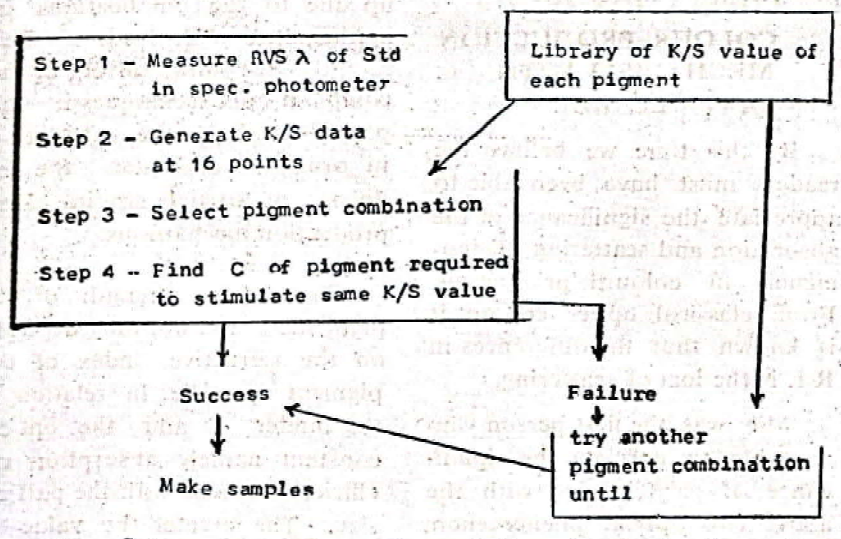



Fig. 28. Schematic representation of flow-chart showing steps involved in colour matching (I.C.M.).

11. COLOUR FORMULATION
—(Computer Printout)

ENTER THE STANDARD NAME—X (28-9203)

IS STD ON FILE ? (Y or N) ? N

COM I PORT SUCCESS-FULLY OPENED

MEASURE PANEL, THEN PRESS RETURN

THE PRESS—75 ON SPECTROPHOTOMETER

NOW DISPLAYING DATA.

| WAVE LENGTH IN N.M. | % REFLECTANCE |
|---|---|
| 400 | 33.93 |
| 420 | 45.82 |
| 460 | 50.66 |
| 480 | 51.36 |
| 500 | 52.38 |
| 520 | 54.66 |
| 540 | 56.07 |
| 560 | 56.90 |
| 580 | 57.56 |
| 600 | 57.71 |
| 620 | 57.32 |
| 640 | 56.87 |
| 660 | 56.60 |
| 680 | 56.16 |
| 700 | 55.53 |

| | ILLUM. C. (Day light) | ILLUM. A. (Horizon light) |
|---|---|---|
| X | 54.52 | 62.44 |
| Y | 56.05 | 56.56 |
| Z | 58.80 | 17.88 |
| CIEL* | 79.64 | 79.93 |
| CIEA* | −1.07 | 0.69 |
| CIEB* | 6.39 | 6.35 |

COLOUR FORMULATION

Enter Pigments Cobination
(when finished enter number 0)

? 10 (coded for white)
? 7640 (coded for red)
? 8906 (coded for yellow)
? 304 (coded for black)
? 0

OPTION 1, 2 or 3 ? 2 (defines extent of metamerism needed whether colour to be matched only in day light ? or colour should match equally in day and night etc. ?)

COMPUTATION IN PROGRESS

ILLUM C.

| | STANDARD | MATCH | DIFFERENCE |
|---|---|---|---|
| L | 79.64 | 79.64 | −0.00 |
| A | −1.07 | −1.07 | −0.00 |
| B | 6.38 | 6.38 | −0.00 |

DELTA E−0.007

ILLUM A.

| | | | |
|---|---|---|---|
| L | 79.93 | 79.94 | −0.00 |
| A | 0.69 | 0.69 | −0.00 |
| B | 6.35 | 6.36 | −0.00 |

DELTA E=.007

ENTER DESIRED TOTAL PARTS ? 100
FORMULATION

| INGREDIENTS | AMOUNT | PARTS | |
|---|---|---|---|
| 10 | 66.91 | 66.91 | |
| 365 | 30.28 | 30.28 | (coded for binder) |
| 7640 | 1.69 | 1.69 | |
| 304 | 0.98 | 0.98 | |
| 8906 | 0.15 | 0.15 | |
| | | 100.00 | |

*(This experiments has been done by the authors in the Application Research and Development—Paints department of M/s Indian Explosives Ltd. at their Rishra Factory—Now renamed as M/s I. C. I. India Ltd.).*

## 12. CORELATION OF COLOUR PRODUCTION MECHANISM WITH PARTICLE SIZE

By this time we believe the readers must have been able to appreciate the significance of the absorption and scattering phenomenon in colour production. From classical optics concept it is known that the differences in R.I. is the loci of scattering.

Mie was the first person who was able to corelate the significance of particle size with the above two optical phenomenon. The application of Mie's theory to the pigment particles were held up due to the complications in mathematics involved. But recently due to the advent of the computational techniques it was possible to derive the calculation in order to understand the influence of particle size in colour production mechanisms.

The colour strength of the pigmented film not only depends on the refractive index of the pigment particle in relation to the binder $\eta$ and the optical constant namely absorption coefficient but also with the particle size. The greater the value of $\eta$ the higher is the extent of scattering.

Lorentz-Lorentz expression

$$M = \frac{\left(\frac{\eta p}{\eta b}\right)^2 - 1}{\left(\frac{\eta p}{\eta b}\right)^2 + 2}$$

where $\eta p$ = R.I. of pigment and $\eta b$ = R.I. of binder

From which the optimum particle size (considering particle as a sphere and expressed in terms of the diameter of the sphere) can be expressed as

$$d\ optim = \frac{\lambda}{\sqrt{2}\, n_o\, M\, \pi}$$

M = Lorentz-Lorentz expression

Table – 15 thus shows the optimum pigment particle size to achieve best colour effect in the tristimulus calculated with the above equation

for all values of $\eta$ and K and is proportional to $\frac{1}{d}$

where d = particle diameter, as d decreases colour strength increases.

For very small particles the theory predicts that the colour strength is independent of particle size at all values of $\eta$ and K. For particles in the middle range of sizes from diameter 0.05 to 0.5$\mu$ that is about $\frac{1}{2}$ the wave length of the incident light, colour strength depends on the values of optical constants $\eta$ and K.

Following figure no. 30 shows the curves derived from Mie's theory with three special combination of these two parameters.

a) [When $\eta = 2.0$ ; $K = 0.05$]
The optical constant of some of the inorganic coloured particle lie in this region. The graph between colour strength and particle size passes through a sharp maxima at about d = 0.2$\mu$ Optimum colour strength is achieved in practice with these type of pigments having a narrow size distribution around 0.2$\mu$. That is mean median at 0.2$\mu$ and standard deviation as low as possible.

(Fig. 30 on overleaf)

b) [When $\eta = 1.0$ and $K = 0.5$]
Organic pigments have relatively high K value in the region of their $\gamma$ max where $\eta$ lies between 1.0 and 1.5. Optimum coloured strength is achieved when d is reduced to about 0.1$\mu$. Particle above this size do not give their maximum colour strength.

c) [When $\eta = 1.0$ $K = 1.0$]
This high K values in conjunction with relatively small R.I. differences are found with carbon black pigments with such pigments optimum colour strength are not achieved unless the particles are reduced below 0.05$\mu$ in size. For a particle greater than this the colour strength is very much influenced with d.

A study of this three curves shows that for the (b) type where $\eta = 1.0$ and $K = 0.5$, a slight flocculation of pigment in the season should produce only a slight decrease in colour strength. This curve represents a majority of azo pigments and such type of pigments usually does not give flocculation trouble on proper adjustment of electrial double layer and zeta potential.

TABLE—15

**Optimum Particle Size In Three Primaries**

| Pigment type | Colour (λ) | d optim in $\mu$m Blue (450 n.m.) | Green (560 n.m.) | Red (590 n.m) |
|---|---|---|---|---|
| Rutile | | 0.14 | 0.19 | 0.21 |
| Anatese | | 0.16 | 0.22 | 0.23 |
| $TiO_2$ : $CaSO_4$ :: 1 : 1 | | 0 19 | 0.27 | 0.29 |
| Basic carbonate white $P_b$ | | 0.26 | 0.37 | 0.40 |
| ZnO | | 0.28 | 0.39 | 0.42 |
| $TiO_2$ : $CaSO_4$ :: 3 : 7 | | 0.26 | 0.36 | 0.38 |
| Barytes | | 1.07 | 1.30 | 1.36 |
| $CaCO_3$ | | 1.44 | 1.74 | 1.84 |

Calculated from $d\ optim = \frac{\lambda}{\sqrt{2}\,\eta_o\,\pi\,M}$

Mie's theory predicts that, for large particles, the colour strength is approximately same

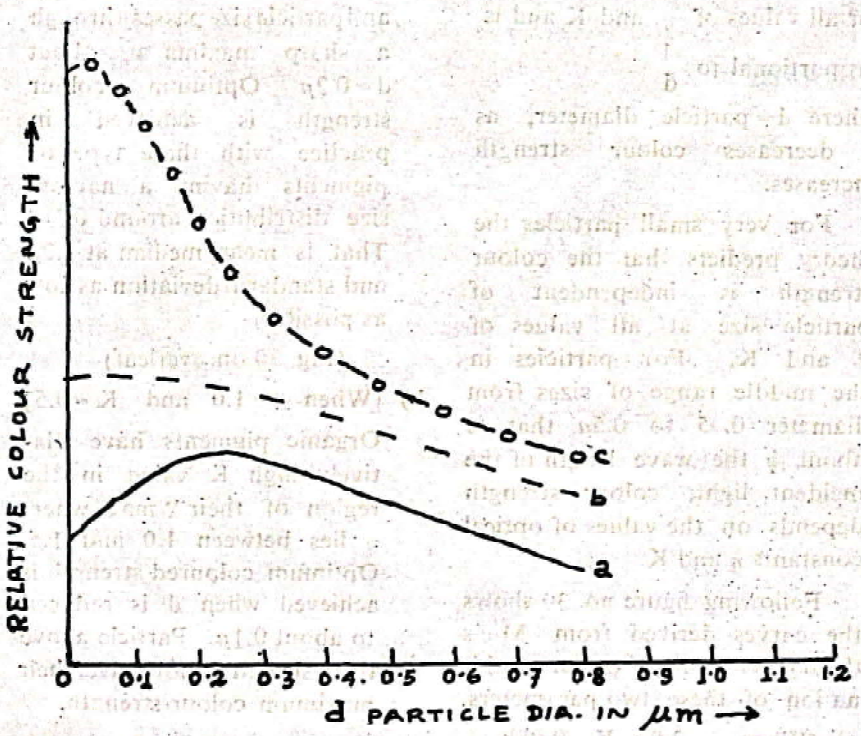



Fig. 30. Colour strength vs particle size.

## 13. REDNESS, GREENNESS AND BLUENESS OF A COLOUR

As has been described vide Grassman's Law that any colour is composed of the above mentioned three stimulus. From the XYZ value or L, a, b values it is possible to calculate numerically total redness, greenness and blueness of any colour.

If these amounts are designated as R, G, and B respectively then

$$R = 1.1084\,X + 0.0852\,Y - 0.1454\,Z$$

$$G = -0.0010\,X + 1.0005\,Y + 0.0004\,Z$$

$$B = -0.0062\,X + 0.0394\,Y + 0.8192\,Z$$

or in short to close approximation

$$R = 1.02X,\ G = Y,\ B = 0.847\,Z$$

again with respect to L, a, b the relationship are :

$$L = 25.29\,G^{\frac{1}{3}} - 18.38$$

$$a = Ka\,(R^{\frac{1}{3}} - G^{\frac{1}{3}})$$

$$b = Kb\,(G^{\frac{1}{3}} - B^{\frac{1}{3}})$$

where Ka = 105.0, when R<G,
Kb = 30.5 when B<G
and
Ka = 125 0, when R>G,
Kb = 53.6 when B<G

or in short,

$$L = 10\,G^{\frac{1}{2}}$$

$$a = 17.5\,(R-G)/G^{\frac{1}{2}} \text{ and}$$

$$b = 7.0\,(G-B)/G^{\frac{1}{2}}$$

again from the spectrophotometric data the scanning of reflectances in 16 wave lengths are known (400, 420, 440, .... 700). From this data it is possible to find out reflectance value corresponding to red, green and blue. These are having λ max at 700 n.m., 546.1 n.m. and 435.8 n.m. Hence reflectances of any colour at these wave length with respect to that of white will be equal to R, G, B value of the colour in question. From this also we can calculate back XYZ or L, a, b values by solving those sets of equations.

The question may be spectrophotometer except for 700 n.m. does not scan the % R at 546.1 n.m. for G or 435.8 n.m. for B, then how can we get the reflectances at these two wave lengths ?

The reflectances at these (546.1 and 435.8 n.m. wave length) can be obtained by interpolation method.

Interpolation is an art of reading between lines. Because of its generality usually Lagrang's Interpolation can be recommended. (Since here band width is same and 435.8 and 546.1 n.m. is in the forward position of the series of wave lengths Newton's forward interpolation technique will also hold equally good).

**Example for Lagrange's interpolation :**

If yo, $y_1$, $y_2$ y be the function of $x_o$, $x_1$, $x_2$ ... $x_n$ in a table and if it is required to find the value of y corresponding to a specific value of x (not given in the table) then Lagrange's interpolation formula states :

$$y = \frac{(x-x_1)(x-x_2 \ldots (x-x_n)}{(x_o-x_1)(x_o-x_2 \ldots (x_o-x_n)} y_o + \frac{(x-x_o)(x-x_2) \ldots (x-x_n)}{(x_1-x_o)(x_1-x_2) \ldots (x_1-x_n)} y_1 + \ldots + \frac{(x-x_o)(x-x_1) \ldots (x-x_{n-1})}{(x_n-x_o)(x_n-x_1) \ldots (x_n-x_{n-1})} y_n$$

Supposing if from the following table if we had to determine the % reflectance at say, 700 n.m. then we shall see how to calcutate.

TABLE—16

% Reflectance vs Wave Length In n.m. Data

| Wave length (x) | 400 | 500 | 600 | 800 |
|---|---|---|---|---|
| % reflectance ÷100 y=f(x) | 3.11 | 2.96 | 2.85 | 2.70 |

LAGRANGE'S INTERPOLATION :

$$\text{then } f(700) = \frac{(700-500)(700-600)(700-800)}{(400-500)(400-600)(400-800)} \times 3.11 + \frac{(700-400)(700-600)(700-800)}{(500-400)(500-600)(500-800)} \times 2.96 + \frac{(700-400)(700-500)(700-800)}{(600-400)(600-500)(600-800)} \times 2.85 + \frac{(700-400)(700-500)(700-600)}{(800-400)(800-500)(800-600)} \times 2.70$$

$$\frac{[2\times1\times(-1)]\times100}{[(-1)\times(-2)(-4)]\times100} \times 3.11 + \frac{[3\times1\times(-1)]\ 100}{[1\times(-1)(-3)]\ 100} \times 2.96 + \frac{[3\times2\times(-1)]\ 100}{[2\times1\times(-2)]\ 100} \times 2.85 + \frac{[3\times2\times1]\ 100}{[4\times3\times2]\ 100} \times 2.70$$

$= \frac{1}{4}(3.11) + (-1)\,2.96 + \frac{3}{2}\,2.85 + \frac{1}{4}\,2.70$

$= 0.7775 - 2.9600 + 4.2750 + 0.6750$

$= 2.77$ hence % reflectance at 700 would be approximately 27.7% = Rc

Similarly Rw (redness of white) can be calculated. Redness of the sample $= \frac{Rc}{Rw}$.

Since here band width was 100 n.m. it will be improper to draw a conclusion like this but closer the band width of scanning better would be the prediction in values of f (λ). With 20 n.m. band width relatively much accurate prediction of this is possible.

## 14. SIGNIFICANCE OF K-M EQUATION

We have seen one of the most quantitative use of Kubelka-Munk equation for colour match prediction. Here we shall illustrate some more significant aspects. S and K values of a surface coating is the scattering and absorption properties of the system. Since vehicle (binder) contributes less scattering. Scattering can be considered as from the pigments only. For white it is the maximum and for black it is minimum. The reverse order is true in the case of absorption for this two class of pigment. The theoritical graph shown below reflects the inverse relationship between K/S and R (vide figure no. 31).

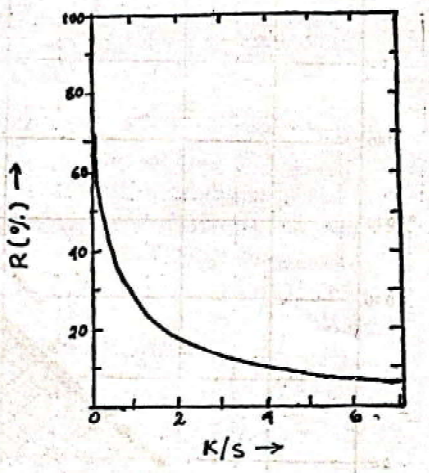



Fig. 31. Exponential relaionship between R (%) and K/S.

Since R∝ is fractional/decimal reflectance the equation derived by Kubelka-Munk *i.e.*, $\frac{K}{S} = \frac{(1-R\infty)^2}{2R\infty}$ can be stated as $\frac{K}{S} = K_1 \times \frac{1}{R}$

When $K_1$ = constant or $\frac{K}{S} \propto \frac{1}{R_\infty}$

again if S remains constant $K_\infty \frac{1}{R_\infty}$

when K remains constant $S_\infty R_\infty$

This is why in practice mixing of little absorbing pigment along with excess of white reduces the reflectance on the other hand mixing of small amount of white with excess coloured pigment increases reflectance value.

More importantly it was D. B. Judd, who was plotted a graph known as "Judd graph" as shown in figure no. 32. In the history of pigment technology this serves an useful tool.

Along the abscissa the contrast ratio (reflectance of a coating over a black surface ÷ reflectance of the same over white surface when applied in identical condition and equal film thickness). The ordinates are the reflectance value over black substrate. The family of curves running from the lower left to the upper right are the $R_\infty$ value whose values are identified by the numbers listed on the right hand side vertically. The family of curves running more nearly vertically are the light scattering characteristics of the paint. Each curve is the S value multiplied by its thickness X. This product SX is also called as scattering power.

Thus if for a known film thickness we measure RW and RB values then we will get the C.R. Now this point may be located on the graph with $(C_R, R_B)$ as (x, y). The $R_\infty$ value may be obtained by interpolating from the nearest $R_\infty$ curves and the Sx values from the SX curves. SX values divided by the X will give the scattering co-efficient value of the paint.

Calculation may be obtained with regard to the hiding power of the coating. Contrast ratio of 0.98 is considered to be the specification for assigning complete hiding. Qualitatively hiding power can be specified by measuring both CR and the film thickness (X) of a number of panels and interpolating these values to know the film thickness exactly for CR value 0.98. Considering X as f (CR).

Following figure no. 33 is

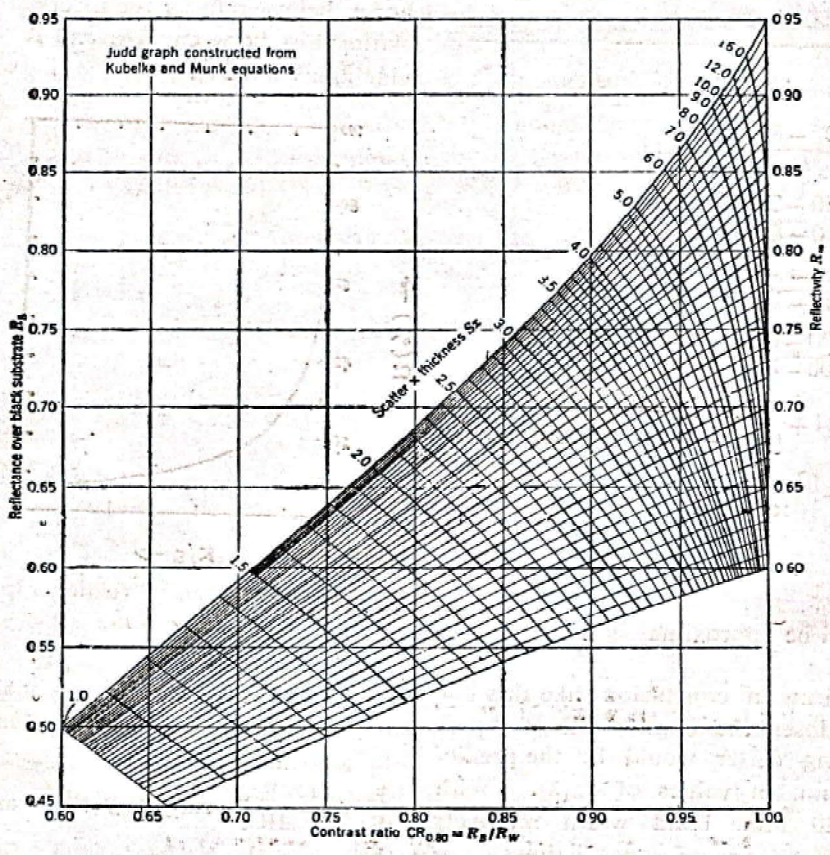



Fig. 32. Judd's graph.

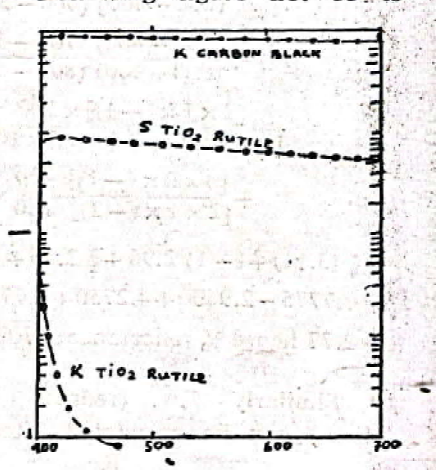



Fig. 33 : Absorption and scattering of Rutile and carbon black as a function of wave length λ in n.m.

very significant. It reflects the absorption and scattering of rutile ($TiO_2$) and carbon black.

This shows that $TiO_2$ scatters through out the visible spectrum but the amount of scattering at 420 n.m. is nearly twice than that at 700 n.m. This increased scattering in violet tends to off-set some of the absorption of rutile in violet. Hence relatively higher reflectance in green, yellow and orange region resulting yellowish colour. That is why a small amount of blue mixed with white makes white more whiter as yellow and blue are complementary [ from the concept of y-b co-ordinate (+b) and (−b) ]. The higher scattering of rutile $TiO_2$ in violet also increases violet reflectance of all colours with which if it is mixed.

Thus carbon black while it has more absorption in violet then in other region states that, this also should give a yellowish tint. But when black is mixed with white we see a bluish tint, because the scattering of white in violet is twice as high as that in red this is much greater than 20% increase in absorption of black from violet region to long wavelength region.

Considering all these effect the rule of colour mixture can be stated as :

(a) If a pigment is mixed with high amount of scattering pigments, (*viz.* small red in large white) its absorption is of primary importance and scattering is secondary. In this case we can equate its tinting strength with K measured at absorption maximum.

(b) If a pigment is going to be mixed with strongly absorbing and relatively low scattering pigment (*e.g.*, black), its scattering is of primary importance. Here we can equate its tinting strength with S.

(c) If a pigment is used only as a masstone, it is the K/S value that is important.

(d) But for all the above cases it is absolute K and S value of the mixture as well as their ratio (K to S ratio) is most important and that is to be controlled for standardization.

## 15. CONCLUSION

This is in brief what we felt about colour measurement and matching by instruments. At this very moment it is probably easy to appreciate the comments of Mr R R Blakey and G. London. (the comments made in the preface of their book—colour measurement) we quote, "Colour is easy to appreciate, less easy to measure and difficult to understand," unquote.

**Suggested for Further Reading :**

a) Committee on colorimetry of the optical society of America —"The Science of Colour". (Optical Soc, of Am. Washington 36 D.C. 1963).

b) Judd D. B. & Wyszecki G," Colour in business Science and Industry"—3rd Edn. (John Wiley & Sons N.Y. 1975).

c) Wright W. D. "The Measurement of Colour"—4th edn.—Adam Hilger, London 1969 and or, Van Nostrant Reinhold N.Y. 1969.

d) Hardy A.C.—Hand book of colorimetry — Massachusetts Institute of Technology Press, Cambridge, Mass 1936.

e) Billmayer F. W. Jr. and Saltzman M—"Principles of Colour Technology"—Wiley Interscience N. Y. 1966.

f) Proceedings of the 8th Session of the Commission Internationale d' Eclairage 1931—Cambridge University Press 1932.

g) Reports of the colorimetry Committee of the C.I.E. 1967 (summary available in J. of the optical Society of Am. 1968, 58, No. 2 pp 290).

h) M. Moris—*Paint Techol. 24* (1960) 26

i) J. S. Marsh and D. A. Plant—*J. Oil Col. Chem Assn. 47* (1964) 554

j) E. Atherton *J. Soc. Dyers Col. 72* (1955) 389.

k) H. R. Davidson, H. Hemmendinger L. J. L. R. Landry *J. Soc Dyers Col. 79* (1963) 557.

## EXPORTS FALL 1% IN AUGUST TO $33 BILLION; TRADE DEFICIT REMAINS ELEVATED

Outbound shipments from India grew at the slowest pace at $33 billion in August — down 1 per cent compared to past year - according to preliminary data released by the government.

Exports restrictions on items, such as wheat, steel, iron pellets, as well as a delay in execution of orders due to fear of slowdown in developed economies, have led to a flattening of exports. On a sequential basis, exports fell 9 per cent from $36.27 billion in July. On a cumulative basis, India exported goods worth $192 billion during April-August period, up 17.1 per cent year-on-year (y-o-y).

Trade deficit eased to $28.68 billion, but remained elevated in August. In July, the deficit had hit a record high of $30 billion. Similarly, imports remained elevated at $61.68 billion in August, 45.09 per cent y-o-y, as India "stocked up" coal and petroleum products for energy security, commerce secretary BVR Subrahmanyam told reporters.

On a sequential basis, the value of inbound shipments declined by 7 per cent. Based on the current trends, and on a conservative basis, Indian exports will cross $750 billion in FY23, compared to $676 billion in FY22. A 'conservative' target of $450 billion has been set for the merchandise exports, the commerce secretary said, adding that the department's internal target remains at $470 billion.

"Crude and coal dominated the increase in imports, in line with the trend in recent months. The y-o-y dip in exports, led by sectors such as engineering goods, gems and jewellery, and yarns and textiles, suggests a cautious outlook for external demand going ahead," said Aditi Nayar, chief economist, ICRA.

Subrahmanyam highlighted that given the current global scenario, India is not in an uncomfortable position. However, there are headwinds related to the conditions in developed nations and Christmas orders, he added. "Exporters' order books are full, but the orders are getting delayed in terms of execution. They have not been asked to ship. That is the uncertainty that is there," he said. There was a contraction in some of the key drivers of export growth in India. Engineering goods witnessed a 14.59 per cent contraction, gems and jewellery by 4.08 per cent, and cotton yarn by 32.32 per cent, amid tepid demand from Western nations.

However, some items witnessed growth. Petroleum products grew at 9.18 per cent, chemicals 8.03 per cent, electronic goods 46.09 per cent, and rice 30.88 per cent. For a number of global factors, growth in engineering goods exports has come down in the last few months, said Mahesh Desai, chairman, Engineering Export Promotion Council of India.

"Decline in demand from China and recessionary trends in major economies in the West have contributed to the slowdown in exports. The pace of growth also slackened due to export duty on certain steel products including stainless steel products," Desai added.

He further said, "At this point, a fair amount of uncertainty remains due to the looming recession in major economies in the wake of ongoing Russia-Ukraine conflict. Depending on the extent of recession, Indian engineering exporters would be impacted but it is likely to more hit the MSMEs which have grappled with back-to-back challenges such as Covid crisis and the subsequent spike in raw material prices."

*(Business Standard – 03/09/2022)*

## INDIA'S EXTERNAL DEBT RISES 8% TO $620.7 BN TILL MARCH

India's external debt rose by 8.2 per cent year-on-year to $620.7 billion as of March 2022, which according to the Finance Ministry is sustainable. While 53.2 per cent of it was denominated in the US dollar, Indian rupee-denominated debt, estimated at 31.2 per cent, was the second largest, as per the status report on India's external debt released by the ministry. "India's external debt continues to be sustainable and prudently managed. As of end-March 2022, it stood at $620.7 billion, growing by 8.2 per cent over the level a year ago. External debt as a ratio to GDP was 19.9 per cent, while reserves to external debt ratio were 97.8 per cent," it said.

Foreign currency reserves as a ratio to external debt stood slightly lower at 97.8 per cent as of end-March 2022 than 100.6 per cent a year ago. The report said the long-term debt estimated at $499.1 billion constituted the largest chunk of 80.4 per cent, while the short-term debt at $121.7 billion accounted for 19.6 per cent of the total. The short-term trade credit was predominantly in the form of trade credit (96 per cent) financing imports. The sovereign debt at $130.7 billion rose higher by 17.1 per cent over its level a year ago, mainly because of the additional allocation of Special Drawing Rights (SDR) by the International Monetary Fund (IMF) during 2021-22.

The non-sovereign debt, on the other hand, grew 6.1 per cent to $490.0 billion over the level as of end-March 2021, it said, adding commercial borrowings, NRI deposits and short-term trade credit are the three biggest constituents of the non-sovereign debt, accounting for as much as 95.2 per cent. While NRI deposits declined by 2 per cent to $139.0 billion, commercial borrowings at $209.71 billion and short-term trade credit at $117.4 billion rose by 5.7 per cent and 20.5 per cent, respectivel - y, it said. Observing that the debt vulnerability indicators continued to be benign, the report said the debt service ratio fell significantly to 5.2 per cent during 2021-22 from 8.2 per cent in the previous year, reflecting buoyant current receipts and moderating external debt service payments.

The debt service payment obligations arising out of the stock of external debt as of end-March 2022 are projected to trend downwards over the coming years, it said, adding that from a cross-country perspective, India's external debt is modest. In terms of various debt vulnerability indicators, India's sustainability was better than the Low-and Middle-Income Countries (LMICs) as a group and vis-a-vis many of them individually, it said.

*(The Millennium Post – 02/09/2022)*

## INDIAN RUPEE: MORE DOWNSIDE IN INR AGAINST US DOLLAR ON CARDS, BULLISHNESS INTACT ABOVE 78.50 ON SPOT

Over the past one month, Rupee has been an outperformer, thanks to the fall in oil prices, robust FPI flows and hopes of Indian bonds being included in the global bond indices.

Over the past one month, Rupee has been an outperformer, thanks to the fall in oil prices, robust FPI flows and hopes of Indian bonds being included in the global bond indices. However, in spite of the net FPI flows being negative $22.2 billion YTD, Rupee has done quite better than its peers. The table below shows that in spite of FPIs pulling out over $22 billion from Indian stocks and bonds, Indian Rupee has ranked as 7th out of the 26 major currencies. One of the major reasons for this kind of performance is massive intervention from the central bank.

RBI targets two aspects of Rupee:

1. Volatility should be low
2. Indian Rupee should not become an outlier

RBI achieves these objectives by buying USD, when the US Dollar is weaker and selling them, when they are stronger. They have amassed a massive number of reserves and also their interventions via onshore and offshore derivatives makes their intervention quite effective. Macro-economic story remains strong for India and in spite of global economic slowdown and recession in large parts of Europe and also in China, Indian economy should continue to clock growth closer to 7% GDP for FY23. Unlike the inflation problems in several EM and DM economies, in India, inflation has not become a problem. Political

stability and attractiveness of the Indian economy as an investment destination for foreigners can continue to drive structural flows into the country via FDI and ECB.


**Indian Rupee is an interplay of twin factors:** domestic and global. Even though the domestic picture appears strong, the global economic situation remains challenging. Europe and China are facing very difficult economic prospects. Global trade can suffer and that in turn can hamper flows into the emerging markets. Unlike Europe and China, the US economy has been resilient and due to that, the US central bank has one of the most hawkish central banks.

High cost of capital in the US Dollar and tightening USD liquidity is bad news for the flows in the emerging markets. When flows slowdown in EMs, emerging market currencies tend to depreciate against the US Dollar. In such a situation, Rupee may face more depreciation pressures against the USD, in spite of the pace of depreciation being slower than most of its peers.

Price action remains decisively bullish on USD INR. As long as prices are not breaking down below 78.50 on spot, the bullish theme is intact. We could see prices test 80.50 and even 81.00 levels over the medium term.

*(Financial Express – 04/09/2022)*

## DEPARTMENT OF COMMERCE PLANS DEDICATED TRADE PROMOTION BODY

The trade promotion body will formulate and drive overall trade promotion strategy; create and drive India's branding across focus markets and sectors; drive coordinated action across missions, states and export promotion councils; strategic initiatives, including advisory and buyer-seller meet; and develop digital platforms for exporters and buyers.

Based on a 14-volume 'restructuring dossier' by the Boston Consulting Group, the commerce department has already implemented some of the recommendations. *Business Standard* first reported on August 7 that the commerce department has restructured the organisation separating multilateral and bilateral trade-negotiating divisions to allow greater focus on ongoing talks for free-trade deals.

Releasing the dossiers which are yet to be made public, Trade Minister Piyush Goyal said as part of the Karmayogi mission launched by Prime Minister Narendra Modi to reskill and reform Indian bureaucracy, various departments are being restructured.

"Commerce department is privileged to be first off the block. "Our officers worked painstakingly to visualise and recreate what the Department of Commerce should look like to be able to meet the needs of the future and as an immediate task to take the $675 billion exports in 2021-22 to $2 trillion by 2030.

"If we can have a $2 trillion export by 2030, it will change the way India engages with the world," he added. In the revamped structure, Directorate General of Foreign Trade (DGFT) will be positioned as a nodal entity to carry out trade regulation and facilitation.

An e-governance division is proposed in DGFT to ensure sharp focus on digitisation of internal and exporter-focused processes. "The DGFT today is also engaged in trade promotion along with trade policy, data analytics, and dissemination of data. "Its role will now be categorised in different buckets. DGFT will focus on trade logistics and infra strategy, regulation and compliance of trade policy, scheme implementation and monitoring, risk monitoring and e-governance," said Goyal.

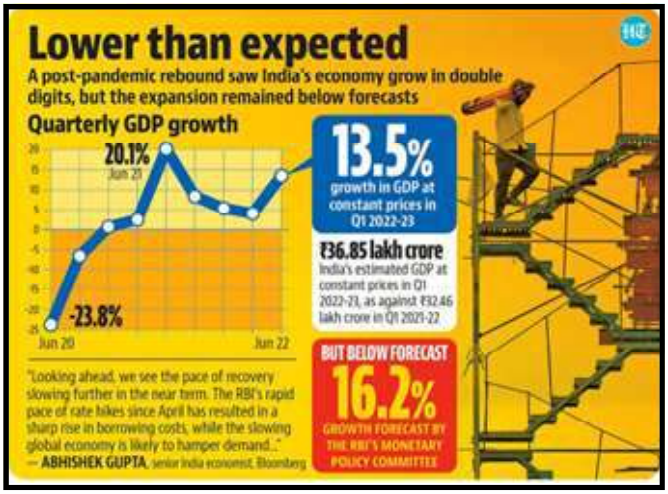
Under the new structure, Indian Trade Service (ITS) will house all expertise on trade matters in the Department of Commerce ecosystem with lateral entry of experts from the private sectors. "The ITS which is a very reputed and valued service with several officers in DGFT can also infuse new talent, both through government recruitment and from the private sector, so that they can have multi-functional teams working in the Department of Commerce.

"This will lead to institutional memory being created so that as officers keep coming and going, long-term institutional memory is retained in the department and we will be able to engage with the world from a position of strength with significant lessons learnt from history," said Goyal. The commerce department plans to overhaul the data and analytics ecosystem via centralised data management and embedded analytics capabilities.

A Trade Intelligence & Analytics wing is proposed to be set up for in-house analytics and dissemination capabilities. Trade Watch Tower within the wing will proactively identify market risks and opportunities. "Our Indian missions abroad will play an increasingly active role for market intelligence, research, and handholding Indian exporters and business persons," added Goyal.

*(Rediff.com – 24/08/2022)*

## Q1 GDP GROWTH BELOW EXPECTATION, CAUSE FOR CONCERN: EX-RBI GUV SUBBARAO




India's GDP growth of 13.5 per cent in the April-June quarter of 2022-23 has turned out be a cause for 'disappointment and concern', as there was expectation of a bigger bounce back from the first quarter of last year when economic activity was crippled by the Delta wave of COVID-19, former RBI governor D Subbarao said on Sunday.

Subbarao added that risk factors for the country's growth outlook in the short term include high commodity prices, possibility of a global recession, monetary tightening by the RBI and an uneven monsoon that could threaten crop output, especially of rice. "The economy clocked growth of 13.5 per cent in the first quarter (April-June) of this fiscal year which would have been cause for celebration in any other circumstance.

"In the event, it's turned out be a cause for disappointment and even concern," he told PTI in an interview. India's economy expanded 13.5 per cent in the April-June quarter, the quickest pace in a year. As per the RBI's estimates, the country's GDP is expected to witness a growth of 7.2 per cent in the current financial year.

"Disappointment because there was expectation of a bigger bounce back from the first quarter of last year when economic activity was crippled by the Delta wave," he said. The GDP growth, though lower than the Reserve Bank of India (RBI) estimate of 16.2 per cent, was fuelled by consumption and signalled a revival of domestic demand, particularly in the services sector

According to Subbarao, the GDP growth in the first quarter turned out to be a cause of concern because contrary to what the headline numbers indicate, there has in fact been a slowdown in the growth momentum which points to growth decelerating further in the quarters ahead.

Gross domestic product (GDP) growth of 13.5 per cent year-on-year compares to a 20.1 per cent expansion a year back and 4.09 per cent growth in the previous three months to March. He observed that in order to get to USD 5 trillion over the next 4-5 years, India should be growing consistently at 8-9 per cent which requires us to be firing on all cylinders, but most of the country's growth drivers are ebbing.

In 2019, Prime Minister Narendra Modi envisioned to make India a USD 5 trillion economy by 2024-25. According to Subbarao, while private investment, which has been subdued for the last several years, has yet to take off, exports which drove the strong recovery last year are facing headwinds because of a global slowdown. Besides, raising public investment will be challenged by fiscal constraints.

"As a result, the sole engine that drove growth in the past quarter was private consumption which expanded robustly on account of the services sector reopening, but whether it can be sustained will depend on the benefits of growth going to the lower income segments of the population," he argued.

To a query on weakening of the Indian rupee to a record low, Subbarao said the rupee has depreciated by about 7 per cent against the US dollar on account of capital outflows and a rising current account deficit. Even so, the rupee has been more resilient compared to other emerging market currencies, as reflected in the broader 40 currency real effective exchange rate (REER) which is still over 100, Subbarao said.

"Rupee movement going forward will largely depend on commodity prices and financial conditions in the global economy, in particular the monetary policy stance of the US Federal Reserve," he noted. Asked what does rupee at 80 to a dollar mean for common Indians, he said depreciation will bring in imported inflation but it will also be expansionary in the sense that it will provide support for exports.

"The challenge for policymakers is to determine to what extent the rupee should be allowed to be a shock absorber given these conflicting objectives," he added. Responding to a question on the widening trade deficit, he said while export prospects will be dented by the global slowdown, the import bill will remain elevated because of high commodity prices.

"It's axiomatic that narrowing the trade deficit will require us to raise our exports and reduce our imports," Subbarao said, but added that this should not mean going back to the protectionist regime of the pre-reform era. The merchandise trade deficit has been widening month on month with a record high of USD 31 billion in July, up from USD 29 billion in June, driven by falling export growth and sticky imports.

While noting that the production linked incentive (PLI) scheme is a big incentive for exports and the government should expand the sectors covered by PLI cautiously based on experience gained, he said further export incentives beyond the PLI will be inadvisable as they will breed inefficiency, besides being costly.

*(Business Standard – 04/09/2022)*

## EDII LAUNCHES MICRO SKILL ENTREPRENEURSHIP PROGRAMME TO FOSTER 10K WOMEN-LED GREEN BUSINESSES


The Entrepreneurship Development Institute of India (EDII), an entrepreneurship training institute, is launching a a skill development, entrepreneurship programme for women-led green businesses across 100 districts in India. The aim is to enable 10,000 women start and manage a business that will be registered as MSMEs. The announcement was made on Friday at India International Centre (IIC) in New Delhi during a roundtable discussion on the modus-operandi of the programme.

The programme is aimed at creating and fostering women entrepreneurs mostly in tier-II and tier-III cities within a time frame of 1,000 days. Sunil Shukla, Director General of the institute, told FEAspire (erstwhile Financial Express Online) that they will be identifying the beneficiaries for the programme amongst the existing women practising green entrepreneurship, the students at the institute and at other educational institutes that are EDII's partners. The focus, said Shukla, will be on handholding existing informal entrepreneurs and the new ones to help them create a business model, avail credit and access institutional support.

EDII has partnered with corporates such as like Accenture, Facebook, Bayer Foundation, HSBC Bank, Walmart, ITC, Yes Bank, ONGC and Amazon for its Micro Skill Development Programme (MSDP) to develop several green businesses including urban terrace gardening kits, bamboo crafts, mushroom cultivation, organic fertilizers, beekeeping, and biodegradable plates made from leaves .

The programme would delve into sectors including agriculture, food processing, healthcare, renewable energy, algae-based water pollutant removal, handicraft, handloom and organic farming to name a few.

"The duration of the programme would be 1,000 days as the mortality rate of new businesses is very high and the first three years are the most vulnerable for any business to sustain," explained Shukla. Enrolling in the programme will help the entrepreneurs to register themselves as MSMEs. "Our target is to register all the beneficiaries as MSMEs so they are able to access government schemes like Mudra and credit guarantee scheme. We will also get their Udyog Aadhar made and register them on the Government's e-marketplace (GeM)."

"Rural entrepreneurship has the potential to power over 70 per cent of the Indian economy with the right set of skills and low-cost technology for the right set of people. Without ideas from rural areas turning into living enterprises there is no Aatmnirbhar Bharat," he added. Raman Gujral, Director, Department of Project (Corporates), EDII, highlighted the growing requirement for high-end, value-added products and services in the market with minimal environmental harm. "The need for sustainability in business applies to both big corporates and small enterprises. There is a need for newer innovations and eco-friendly practices both in rural and urban sectors," he said.

*(Financial Express – 02/09/2022)*

## INDIA INFLATION RATE LIKELY ROSE TO 6.9% IN AUGUST, SAYS DEUTSCHE BANK


Deutsche Bank estimates that India's consumer price index (CPI) firmed to 6.9% year-on-year in August, while core inflation likely stood at 6%.

The Asian nation will report the data next Monday. While Brent crude oil prices have recorded a steep decline in recent weeks, the favourable impact will be less reflected in the CPI as fuel items account for a very small weight, Deutsche Bank said. Meanwhile, the risks to food inflation persist with negative seasonality kicking in for the September-November period, the bank said.

"Key vegetables tend to shoot up during this period," said Kaushik Das, chief economist for India and South Asia at Deutsche Bank. Besides seasonality, Das highlighted that sowing of pulses has also fallen by 5% year-on-year. "These could be potential risk factors, which could keep food inflation momentum high, consequently resulting in an elevated CPI closer to the 7% mark," he said.

The Reserve Bank of India will continue with rate hikes, likely delivering another 75 bps to 85 bps bump up in the rest of this financial year, Das said. "Though we would expect the central bank to hike rates in smaller clips from the September meeting, given the significant front-loading (around 200 bps - 205 bps of tightening has already happened) that has already been delivered to protect against future growth headwinds."

*(Business Standard – 06/09/2022)*

**-: JILTA : -**

***Owner**: Indian Leather Technologists' Association, **Publisher & Printer**: Mr. S. D. Set, **Published From**: 'Sanjoy Bhavan', (3rd floor), 44, Shanti Pally, Kasba, Kolkata - 700107, West Bengal, INDIA and **Printed From**: M/s TAS Associate, 11, Priya Nath Dey Lane, Kolkata- 700036, West Bengal, INDIA*

# ILTA PUBLICATION

Now available


Title of the Book
Treatise on Fatliquors and Fatliquoring of Leather

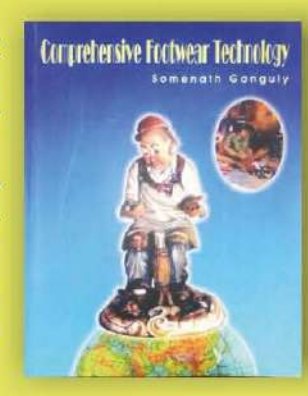
Author
Dr. Samir Dasgupta

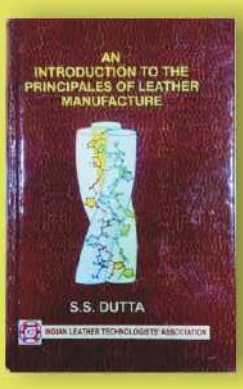
Price per copy*
₹1500.00 / $ 60.00

Title of the Book
Comprehensive Footwear Technology

Author
Mr. Somenath Ganguly

Price per copy*
₹ 500.00 / $ 50.00




Title of the Book
An Introduction to the Principles of Leather Manufacture

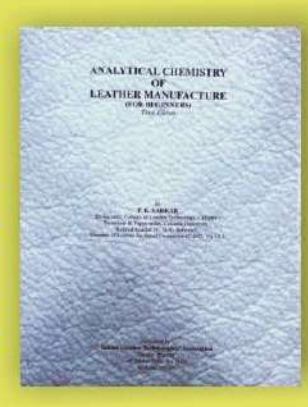
Author
Prof. S. S. Dutta

Price per copy*
₹ 800.00 / $ 50.00

Title of the Book
Analytical Chemistry of Leather Manufacture

Author
Mr. P. K. Sarkar

Price per copy*
₹300.00 / $ 10.00





Title of the Book
Synthetic Tanning Agents

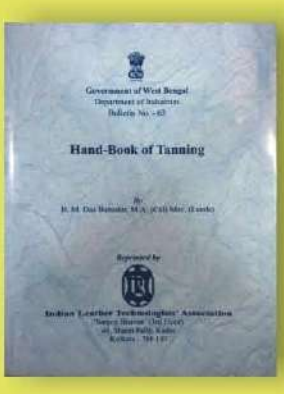
Author
Dr. Samir Dasgupta

Price per copy*
₹ 900.00 / $ 30.00

Title of the Book
Hand- Book of Tanning

Author
Prof. B. M. Das

Price per copy*
₹ 750.00 / $ 25.00




*Packing and forwarding charge extra

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Registration No. KOL RMS/074/2019-21

# History and Activities of Indian Leather Technologists' Association

The Indian Leather Technologists' Association (ILTA) was founded by Late Prof. B. M. Das, the originator of Das-Sibaney theory and father of Indian Leather Science on 14th August 1950.

The primary objectives of the oldest Leather Technologists' Association which celebrated its Diamond Jubilee year in the 2010, are :

- To bring all concerned with the broad spectrum of the leather industry under one umbrella.
- To organize seminar, symposium, workshop in order to create information, knowledge and latest development for the benefit of all concerned. To offer a common platform for all to interact with each other in order to understand each other's problems and prospects.
- To publish monthly journal as a supplement to those above objectives. The monthly journal of ILTA is known as journal of Indian Leather Technologists' Association and is the most widely circulated technical journal concerning leather technology.
- To publish text books for the benefit of students at various levels of study, for the researchers and industry.
- To have interface between urban and rural sector.
- To assist Planning Commission, various Government Institutions, Ministry and autonomous bodies to formulate appropriate policies acceptable and adoptable to the industry.
- To organize practical training and to provide skilled manpower and to motivate good students for study.
- To conduct activities related to the growth of the export of leather and leather goods from India.
- As the part of many social activities ILTA has donated Rs. 1 lac to Consul General of Nepal towards relief of earthquake effected of Nepal on 16th Sept, 2015.

INTERNATIONAL & NATIONAL SEMINAR

- ILTA is the Member Society of International Union of Leather Technologists & Chemists Societies (IULTCS), a 115 years old organization and for the first time the IULTCS Congress was organized in January 1999 outside the developed countries in India jointly by ILTA and CLRI.
  2017 IULTCS Congress is scheduled to be held in India again.
- 8th Asian International Conference on Leather Science & Technology (AICLST) was organized by ILTA in 2010 during its' Diamond Jubilee Celebration year.

SEMINAR & SYMPOSIUM

ILTA organizes Seminar & Symposiums on regular basis to share information, knowledge & latest development and interactions for the benefit of all concerned. Few are as under :

- Prof. B. M. Das Memorial Lecture every year during the Foundation Day Celebrations on 14th August every year.
- Sanjoy Sen Memorial Lecture on 14th January every year, the birthday of our late President for several decades.
- Prof. Moni Banerjee Memorial Lecture on 15th March every year, the birthday of this iconic personality.
- Seminar on the occasion of India International Leather Fair (IILF) at Chennai in February every year.

It has also organized :

- Prof. Y. Nayudamma Memorial Lecture.
- Series of Lectures during "Programme on Implementing Emerging & Sustainable Technologies (PrIEST)".
- Seminars in occasion of India International Leather Fair, 2014 and 2015 at Chennai etc. Many reputed scientists, industrialists and educationists have delivered these prestigious lectures. Foreign dignitaries during their visits to India have addressed the members of ILTA at various times.

PUBLICATION

ILTA have published the following books :

- An Introduction to the Principles of Physical Testing of Leather by Prof. S. S. Dutta
- Practical Aspects of Manufacture of Upper Leather by J. M. Dey
- An Introduction to the Principles of Leather Manufacture by Prof. S. S. Dutta
- Analytical Chemistry of Leather Manufacture by P. K. Sarkar
- Comprehensive Footwear Technology by Mr. Somnath Ganguly
- Treatise on Fatliquors and Fatliquoring of Leather by Dr. Samir Dasgupta
- Synthetic Tanning Agents by Dr. Samir Dasgupta
- Hand Book of Tanning by Prof. B. M. Das

ILTA has a good Library & Archive enriched with a few Important Books, Periodicals, Journals etc.


AWARDS OF EXCELLENCE

- ILTA awards Prof. B. M. Das Memorial, Sanjoy Sen Memorial, J. M. Dey Memorial and Moni Banerjee Memorial Medals to the top rankers at the University / Technical Institute graduate and post graduate levels to encourage the brilliants to evolve with the Industry.
- J. Sinha Roy Memorial Award for the author of the best contribution for the entire year published in the monthly journal of the Indian Leather Technologists' Association (JILTA).

LEXPOs

To promote and provide marketing facilities, to keep pace with the latest design and technology, to have better interaction with the domestic buyers, ILTA has been organizing LEXPO fairs at Kolkata from 1977, Siliguri from 1992 and Durgapur from 2010. To help the tiny, cottage and small-scale sectors industries in marketing, LEXPO fairs give the exposure for their products. Apart from Kolkata, Siliguri & Durgapur, ILTA has organized LEXPO at Bhubaneswar, Gangtok, Guwahati, Jamshedpur and Ranchi.

MEMBERS

The Association's present (as on 31.03.2018) strength of members is more than 600 from all over India and abroad. Primarily the members are leather technologists passed out from Govt. College of Engineering & Leather Technology, Anna University, Chennai, Harcourt Butler Technological Institute, Kanpur, B. R. Ambedkar National Institute of Technology, Jalandhar and Scientists from Central Leather Research Institute.

ESTABLISHMENTS

In order to strengthen its activities, ILTA have constructed its own six storied building at 44, Shanti Pally, Kasba, Kolkata – 700 107 and have named it "Sanjoy Bhavan".
This Association is managed by an Executive Committee duly elected by the members of the Association. It is absolutely a voluntary organization working for the betterment of the Leather Industry. None of the Executive Committee members gets any remuneration for the services rendered but they get the satisfaction of being a part of this esteemed organization.

ILTA
Since 1950

## Indian Leather Technologists' Association

[A Member Society of International Union of Leather Technologists' and Chemists Societies]

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