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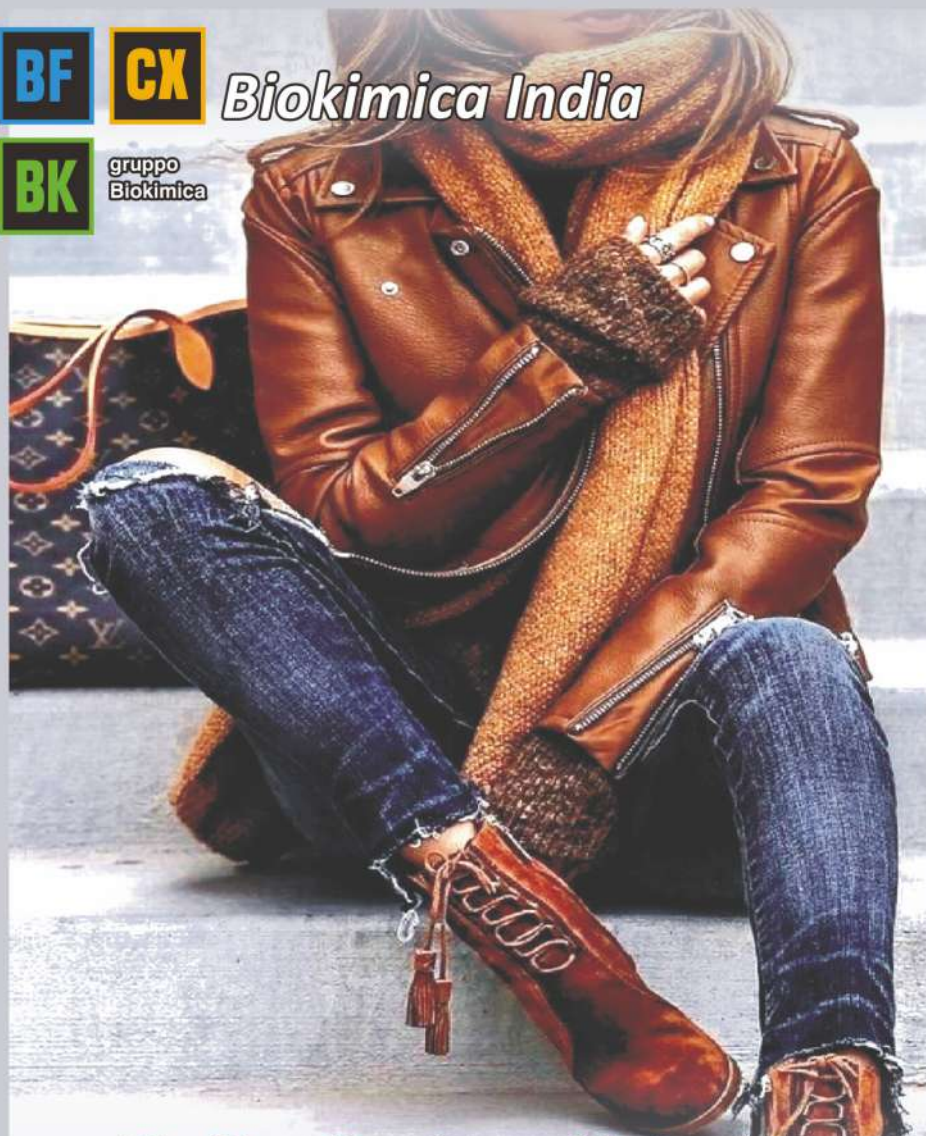
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As per the latest report of CRISIL-the rating agency, India's leather and allied products industry, will see a 10-12% decline in revenue during the current financial year, due to the steep imposition of 50% duty by the United States. The 50% tariff (25% reciprocal tariff plus 25% penalty for purchase of Russian oil) imposed on Indian goods will slash export volume, the rating agency said.

Crisil Ratings analysed 34 leather firms representing approximately 12.5% of the sector's total revenue. The industry, estimated to have generated around Rs. 56,000 crores in FY25, and exports accounted for nearly 70% of this income. Of this, over 50% of exports go to the European Union, while the United States accounts for around 22%.

The agency believes that with the high export concentration, companies would witness a decline, despite a moderate improvement in domestic demand, thanks to the rationalisation of Goods and Services Tax (GST), besides other favourable macro-economic factors, such as lower income taxes, benign inflation, and low interest. In the domestic market, on the other hand, the reduction of GST on leather products from 18% to 12% is expected to enhance affordability and drive premiumisation.,

Exporters are of the opinion that there would be a 5-8% drop in shipments in FY26 due to higher tariff, but they say, strong domestic demand and FTAs will help cushion the impact to a certain extent.

The decline in export demand, along with steady supply, may put downward pressure on raw material prices. The marginal decline seen in raw and tanned leather prices will provide some relief to exporters, but not enough to offset the tariff impact.

Crisil Rating has said, four key factors warrant close monitoring: They are i) the evolving tariff environment and its impact on leather demand, ii) the ability of processors to offset the revenue loss from the US by increasing sales to other markets, iii) the impact of re-export of Indian goods exported to Europe and iv) potential heightened forex volatility.

According to the latest news India and the United States are making significant progress towards finalising a new bilateral trade agreement after several rounds of dialogue. Both nations have reported convergence on core issues, with officials confirming that the legal framework is now under review. However, uncertainties over high US tariffs on Indian goods continue to challenge discussions.



42nd Annual General Body Meeting of IFLMEA

**(A report by Mr. Vasan Suri A Passionate Leather Lover &
Professional, Hi-Tech Consultancy - A well-wisher of
Indian Leather and the Industry)**

The 42nd Annual General Body Meeting of the Indian Finished Leather Manufacturers & Exporters' Association (IFLMEA) was held on 28th August, 2025 at the Hotel ITC Grand Chola, in Chennai.

Shri K R Vijayan, Chairman, IFLMEA, in his address, elaborated the work done by the Association, for the past one year, and he has called for sustainable practices and new innovations to make Leather gain, its prominence in the International market.

Shri K R Vijayan's speech insisted on sustainability / traceability / deforestation / chemicals group collaboration with tanneries, UK-FTA/Trump Tariffs, support from State & Central Government etc.,

The Chairman also underlined the importance of NIFT/FDDI / CFTI / NID, the urgent need for Innovation in leather products & accessories. He was showered with praise by the speakers for his leadership with a calm and composed nature and guiding the IFLMEA, to various heights during his tenure and also constructing a dedicated office for IFLMEA during his tenure.

Mr. Aslam Basha initiated the proceedings of the meeting. The AGM was attended by all the top names of the Industry.

Mr. Mecca Rafeeq Ahmed, Mr. T. Rafeeq Ahmed, Mr. Israr Ahmed, Mr. Aqeel Punaruna, Mr. Raja Srinivasan, Mr. Habib Hussain to name a few, and the members of IFLMEA in large numbers from every part of Tamil Nadu.

The accounts were tabled for the approval of members and the same was done. The auditors answered the queries posted by Mr. Aqeel Panaruna & Mr. Israr Ahmed.

The Dindigul common effluent treatment received the award for excellence in the treatment of pollution waters effectively.





At the AGM, fresh elections were held, and the following were the newly elected office bearers of IFLMEA.

Mr Atheequr Rahman - Chairman

Mr Israr Ahmed Mecca - Vice-Chairman

Mr G Mohamed Jahan - Vice-Chairman

Mr AR Senthil Kumar - Hony Secretary

Mr Salman Parpia - Hony Secretary

Mr Anees Ahmed - Hony Treasurer

Mr. Aqeel Punaruna, in his speech, mentioned that our share of footwear exports to the American market is way behind China, Vietnam, etc., He insisted that our focus should be to keep looking for other markets until the Tariff situation settles down.

The Next Session was a panel discussion on **“Innovative Technology for Tanning Sector”** which comprised three main subjects: **1. Energy Audits and its impacts: 2. Innovative Finishing Technology and 3. Understanding Bisphenols - from Chemistry to Compliance.**

Energy Audits & its impacts

Mr. Jahan called up the representative of M/s. H.S. Energy Audit Company to make his presentation.

This organisation, who have worked in 4-5 tanneries and shoe factories, have highlighted the leakages of power, steam and air in every organisation.

They have brought in machines and insulation systems with the wherewithal as to how to control and save those leakages which would reduce the operating cost of the tanneries and shoe factories.

It was emphasized that the electrical cables need to be changed and solar power to be involved, New Compressors for efficient functioning and the Government schemes to support it.

The whole presentation was well done by the representative of the organisation, M/s. H.S. Energy Audit Company.

TFL - Innovative Technology

The next presentation was done by TFL, wherein, they have chemicals to support the green finishing technology.

TFL was represented by Mr. Sankaralingam who gave a presentation about the Technology which is a release paper technology, and the chemicals, are water based.

Mr. Sankaralingam, highlighted the advantages of the system, upgradation technology of the lower selection and better cutting average of the leathers for the factories.

He was also of the opinion that the release paper could cost Rs.3-4 per sqft and then, the chemicals to be around Rs.10/- per sqft.

The machine is provided by Gemata which will cost nearly Rs.2 crores and the release paper will have to be imported from UK or Japan and these were not produced in India.

GG Organics on Bisphenol

The third presentation was done G.G. Inorganics about the Bisphenol free tanning systems which they were offering to the Leather Industry.

This was followed by Q&A sessions from the members and the details are as below:

1. About stopping of leakage of power, air and steam at the tanneries and factories.
2. Mr. Aqeel Punaruna wanted the practical demonstrations at the tanneries and factories and the results thereof.
3. Mr. Jahan gave his recommendations and personal experiences about the cost saving and he had allowed the presentation only after satisfying himself with the performance.

TFL - Green Technology

1. Mr. Vasan Suri, contended that the cost of the paper per sqft. will be nothing less than Rs.8-10/- per sqft.
2. Though the release paper is reusable it calls for lot of care and efforts to maintain it.
3. Secondly, the investment on the machine and the release paper to satisfy various grain requirements invites for many types of papers in stock and the risk of its maintenance.
4. It is also important to address the minimum quantity of 3000sqft required to run the machine.
5. Overall, it was opined that the cost will be Rs.35/- per sqft. considering all the requirements, on this Green Technology.
6. After all these efforts, the leather gets the look of a synthetic, and why promote leather as synthetic.
7. Dr KJ Sreeram, Director of CLRI joined in the discussion with his concern about disposal of those release papers after use, which will be an another burden on the tanneries.

GG Inorganics

1. Dr. Sreeram strongly opined that, the tanning system should shift back to our traditional vegetable tanning methods with modern systems rather than fighting with these synthetic tanning agents and their conformity on Bisphenol and other hazardous chemicals.
2. Mr. G Raja,CEO.GG Organics gave his points as to how they have designed their products, conforming to all the International standards and this could be proved by his trials.

The AGM thus ended and followed up with a tasteful dinner.



II Deduction and Application of Particle-in-One Dimensional Box Model as per Quantum Theory II

Dr. Buddhadeb Chattopadhyay

1. **Introduction:** Why all on a sudden publishing Quantum Theory? It is a valid question for the Learner-Targets of 21st Century. This is simply because it revolutionized the applications in various fields in which anybody is going to encounter in near future.
- 1.1 **Quantum Chemistry:** To the Physical chemists it has potential and almost correct application and deduction of Thermodynamic properties like heat and entropy etc. with the aid of statistical mechanics of course. To interpret molecular spectra and other molecular properties, like molecular geometrics, dipole moments, energy barrier to internal rotation, energy difference between conformational isomers. To calculate energy difference of quasi-stable transitional states of the chemical reactions, thereby allowing to deduce the rate constants and equilibrium points, to understand molecular forces, including electrovalent, covalent and coordination valent bonds, their length, energies and magnetic properties the H-bonding, Dipole-Dipole interactions, induced Dipole interaction, Van der Waals interactions etc. Organic Chemists use it to assess the relative stabilities of different molecules, elucidate the molecular structure qualitatively and quantitatively within few minutes. They investigate the Reaction Mechanisms of Organic reactions like, SN^1 , SN^2 , E^1 , E^2 , Addition reactions and various rearrangements so to say. Here Nuclear Magnetic Resonance Spectra plays the key role. Inorganic Chemists explore ligand field theory, an approximate quantum mechanical method, to predict properties of transitional metal organo-metallic complexes. Analytical chemists use spectroscopic methods extensively; the frequencies and intensities of the spectra can be

properly understood and interpreted through application of quantum theory.

Although then giant size of biological molecules make it very hard and challenging to apply quantum mechanics; yet it has to be understood that in recent past the Nobel Prizes in Chemistry have been awarded to them for their painstaking effort to use Quantum Mechanical theory. Biologists are now often using Quantum Mechanical tools in their research.

Quantum mechanics determine the properties of nanomaterials (objects with at least one dimension in the range of 1.0 to 100.0 nanometer). When one or two dimension fall below 20 nm, dramatic changes in optical, electronic, chemical and other properties from those of the bulk material do occur. A semiconductor or metal object with one dimension in the range from 20.0 to 1000 nm is called, a **Quantum well**, one with two dimensions within that range is called a, **Quantum Wire**; and all the dimensions in this range is a, **Quantum dot**. The word quantum in their cases are indicative of the key roles played by Quantum Mechanics in determining the properties of them. Quantum Mechanics has a big role to play in the development of nano-science and nano-technologies, which my dear students of the 21st century might have to face.

Modern tech space and Information Technologies armed with Artificial Intelligence and Quantum computing etc will get benefits in realizing the Quantum Mechanics better.

To give an elaborate example we shall discuss at length the application of Quantum Mechanics in Particle-in One Dimensional-box hereunder.

- 2.0 In classical mechanics the motion of a particle is governed by Newton's second law which states: $F = ma = m(d^2x/dt^2)$ if $v \ll c$.

Now one aspect of Quantum Mechanics is to postulate the basic principle and then use this postulate to deduce experimentally testable consequences such as energy levels of atoms; while none has seen an atom neither it falls under our day-to-day scrutiny/experience.

To describe the **state** of a system in Quantum Mechanics, let us postulate, the existence of a function ψ of the particles coordinates called the **State Function** or **Wave Function** (often written as **Wave Function**). Since the state will, in general, change with respect of time, so ψ is also a function of time. For one particle and one-dimensional system therefore, we have $\psi(x, t)$. The wave function contains all possible information of the system, so instead of speaking of, “*State described by the wave function ψ* ”, we simply state, “**The State ψ** ”. To find the future state of a Quantum Mechanical System from the knowledge of the present state, we want an equation that tells us how to wave functions change with time. For one particle-one dimensional system, the equation postulated to be,

$$(\hbar/2\pi i) \cdot \partial \psi(x,t) / \partial t = -(\hbar^2/2\pi \cdot 2m) \cdot \partial^2 \psi(x,t) / \partial x^2 = V(x, t) \psi(x, t)$$

3.0 The Particle-in-one-dimensional-box:

In this section we shall take the time independent Schrödinger’s equation for a particle in one dimensional box. By this we mean that a particle is subjected to a potential energy function is infinite everywhere along the x-axis except for a lone segment of length l , from $x = 0$ to $x = l$ the potential energy is zero everywhere. In other means if we replace a ball by an electron particle, it has no way to cross the infinite potential energy barrier. This is done in order to prevent **Electron Tunneling**. Except in Chemistry, it may appear the model to be unreal but this model has been successfully applied to highly extended conjugated molecules like **β -carotene** (already has been described in October issue of *JILTA*.)

Let us see the figure 2.1, where we put the origin at the left of the line segment.

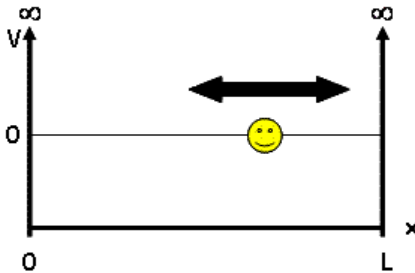


Figure 3.1 (LHS), The happy yellow ball inside the potential well having Potential energy 0, is moving happily to and fro.

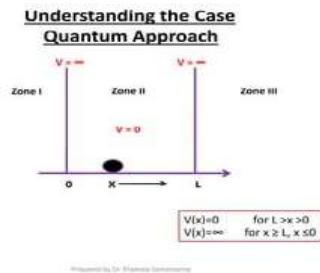


Figure 3.2 (RHS) Quantum Mechanical ball and its behavior in the line segment I, as well as outside.

Now vide figure 2.2, we have to consider the three zones of interest. In Zones I and III, the potential energy $v = \infty$ and the time-independent Schrödinger's equation is :

- $\hbar^2/4\pi m \cdot (d^2\psi/dx^2) = (E - \infty) \psi$ (∞ here is used to symbolize infinity).

Neglecting E in comparison to ∞ , we may write:

$d^2\psi/d^2x = \infty\psi$ or, $\psi = 1/\infty$. $d^2\psi/d^2x$ and we consider now ψ is 0, outside the box, which means $\psi_I = 0$ and $\psi_{III} = 0$; and thus, $|\psi_I|^2 = 0 = |\psi_{III}|^2$

But for the zone II, x between 0 and L , the potential energy $V = 0$ and for this the Schrödinger's equation becomes:

$d^2\psi_{II}/d^2x + 4m\pi/h \cdot E/\psi_{II} = 0$ [where m is the mass of the particle, E is the energy. We recognize the above equation is a linear homogeneous second-order differential equation with constant coefficient]. The auxiliary equation gives:

$$s^2 + 8mE/\pi^2 = 0 \dots\dots\dots(1)$$

$$\text{Or, } s = \pm (-2mE)^{1/2} / (h/2\pi)$$

$$\text{or, } s = \pm i (2mE)^{1/2} / h/2\pi \quad \{\text{Where } i = \sqrt{-1}\}$$

Therefore, we may also write

$$\psi_{II} = C_1 e^{\sqrt{i(2mE).(2x\pi/h)}} + C_2 e^{-i(\sqrt{(2mE).(2x\pi/h)}}$$

$$\text{Temporarily, let us assign } \theta = \sqrt{(2mE).(2x\pi/h)}$$

$$\text{Hence } \psi_{II} = C_1 e^{i\theta} + C_2 e^{-i\theta}$$

Now we have $e^{i\theta} = \cos \theta + i \sin \theta$ and $e^{-i\theta} = \cos(-\theta) + i \sin(-\theta) = \cos \theta - i \sin \theta$. [Because, $\cos(-\theta) = \cos(\theta)$ and $\sin(-\theta) = -\sin(\theta)$]

$$\text{Therefore, } \psi_{II} = C_1 \cos \theta + iC_1 \sin \theta + C_2 \cos \theta - iC_2 \sin \theta$$

$$\text{Or, } (C_1 + C_2) \cos \theta + (iC_1 - iC_2) \sin \theta$$

$$\text{Or, } A \cos \theta + B \sin \theta \quad [\text{Where } A \text{ and } B \text{ are arbitrary constants}]$$

$$\text{Hence } \psi_{II} = A \cos [2\pi/h (2mE)^{1/2}x] + B \sin [2\pi/h (2mE)^{1/2}x]$$

Now we would like to find A and B by applying three boundary conditions a) That the probability of finding the ball at $x = 0$;

In terms of Quantum mechanics, $|\psi|^2$ should be 0; which means that ψ itself should be 0 at $x = 0$

b) That the probability of finding the ball at $x = l$;

In terms of Quantum mechanics $|\psi|^2$ should be 0; which means that ψ itself should be 0, at $x=0$ and at $x = l$

c) the wave function should be continuous and also must conform the normalization conditions. It seems reasonable to postulate that the wave function should be continuous, it will not make a sudden jump in value.

Now if ψ is to be continuous at the point $x = 0$, then both ψ_I and ψ_{II} must approach to the same value at $x = 0$. This means that, the limits of both ψ_I and ψ_{II} must approach the same value at $x = 0$

Now, $\lim_{x \rightarrow 0} [A \cos [2\pi/h (2mE)^{1/2}x] + B \sin [2\pi/h (2mE)^{1/2}x] = 0$

That means, $A = 0$ {Since $\sin 0 = 0$ but $\cos 0 = 1$ }

With $A = 0$ the equation reduces to $\psi_{II} = B \sin [2\pi/h (2mE)^{1/2}x]$

By applying continuity condition at $x = l$, we get $B \sin [2\pi/h (2mE)^{1/2}l] = 0$.

Now B cannot be 0 then the wave function becomes zero everywhere, both inside and outside the one-dimensional well.

Therefore, $\sin [2\pi/h (2mE)^{1/2}l] = 0$

Now zero of the $\sin$ function occur 0 at $0, \pm \pi, \pm 2\pi, \pm 3\pi$ $\pm n\pi$

Hence, $(2\pi/h)(2mE)^{1/2}l = \pm n\pi$

Hence, we get $E = (n^2 h^2)/8ml^2$ [Where $n = 1, 2, 3, 4, \dots$] By plotting this outcome we can find a unique relationship: the energy levels are not equidistant when energy is plotted against as a function of Quantum numbers as depicted in the figure below:

LHS of the Figure No 2.3 below show the value of ψ at different Quantum Numbers inside anywhere of the well, while the RHS show the probability of finding the particle at any point within the well.

It should be reminded here the shape of s, p, d, f orbitals that we find in the Organic Chemistry book are not the orbital path of the rotating electrons in atoms, on the contrary, they are the

probability distribution curves at various levels of l (Azimuthal quantum Numbers) as a function of three cartesian coordinate axes and also the RHS of the plot you can always see that the probability of availability of electrons at the nodal point is zero. They were never to be found at the nodal point/(s).

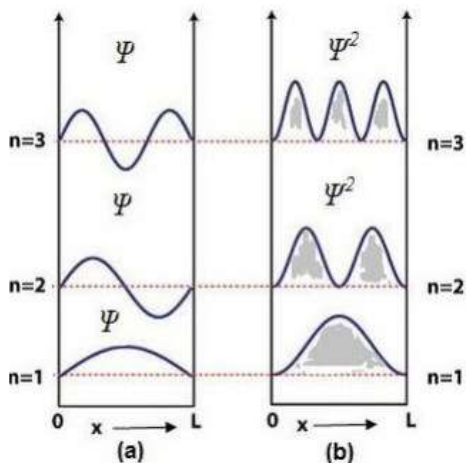


Figure 3.3 Describes the plot/value of ψ as against any point within the line segments at different strata of quantum Numbers, while in the LHS, whereas in the RHS it describes the value of $|\psi|^2$ of the same.

We can also see from the equation $E = (n^2 h^2) / 8 m l^2$ that n is the Principal number which is constant, h is the Planck's constant, m is the rest mass of the particle (here we may also assume an electron), 8 is also a constant. Therefore, it is redundant to say that the energy E of the electron will vary with the square of the length of the well. That is why extended conjugated polyene shows a low energy, meaning higher stability.

From this we can also postulate that for a molecule having N numbers of π electrons, the maximum principal quantum

number n should be equal to $N/2$ (because at Pauli's exclusion principle). So now the next higher energy level should be $(N/2 + 1)$

Now, let us find out the energies of both the levels: -

For $E_{N/2} = (N/2)^2 h^2 / 8ml^2$ and for $E_{(N/2+1)} = (N/2 + 1)^2 / 8ml^2$

Differences of energy levels $\Delta E = E_{(N/2+1)} - E_{N/2} = h^2 [(N/2 + 1)^2 - N/2] / 8ml^2$

Or, $\Delta E = hc / \lambda_{\max} = h^2 (N+1) / 8ml^2$

If we consider n is variable then we can see that ΔE varies directly with N (number of π electrons) but inversely with the square of the width of the well. So if the N increases in AP which may increase the ΔE , but with the increase on N , l also increases since the relationship of l with ΔE is in GP it will nullify the action of increased N .

We may also see that $hc / \lambda_{\max} = h^2 (N + 1) / 8ml^2$

Therefore, $\lambda_{\max} = 8mcl^2 / h.(N+1)$, so we can see also that the absorption of electromagnetic radiation of molecule will be at lower wavelength as the width of the well increases. This is the reason for β -carotene, which has no non-bonding (n) electrons (to favour low energy n to π^* transition), is highly yellow in color (the color of the carrot).

(This article is dedicated to the memory of Dr Doraiswamy Ramaswamy of CLRI Chennai with all due reverence, from whom the author first heard the term "Quantum Mechanics". Later, the author is indebted to Dr. Soumitra Sengupta the eminent Professor of Theoretical Physics Department of Indian Institute of Cultivation of Science, Kolkata, who taught him the kernels, from which, it is difficult to gain the escape velocity/tunneling.)



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51st Simac Tanning Tech closed on a positive note



Simac Tanning Tech : difficult times for Italian leather and fashion industries, but signs are positive

- Despite a 12.8% decline in exports in the first half of 2025, the Italian footwear, leather goods and tanning machinery industry confirms its leadership and propensity for innovation.
- Simac Tanning Tech confirms its status as a strategic business platform, with over 7,000 visitors, approximately 49% of international visitors, and 25% of exhibitors coming from abroad.
- The project to support Africa, promoted by Assomac at the fair, helped strengthen partnerships with many African countries with the aim of contributing to the development of the leather-footwear supply chain. First and foremost was the focus on Kenya, with the presence of government institutions and a large delegation of entrepreneurs.

The 51st edition of **Simac Tanning Tech**, the leading International event for **technology and machinery in the footwear, leather goods and tanning industries**, organised by ASSOMAC from 23-25 September, 2025 at Fiera Milano Rho, Milan, Italy, closed on a positive note, proving itself to be the strategic platform of reference for the sector, capable of generating new connections and business opportunities at an international level. This is confirmed by the figures: **over 7,000 visitors**, approximately **49% of international visitors**, and **25% of exhibitors from around 20 countries**. These results were made possible thanks to the valuable support of the Italian Trade Agency (ITA) and the close synergy with Lineapelle, which led to over 9,000 visitors passing between the two fairs, confirming the importance of Simac Tanning Tech on the global stage.

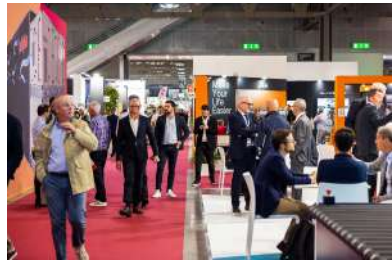
51ST SIMAC TANNING TECH, MILAN, ITALY 23-25 Sep 2025



The highly specialised Italian industry in this sector has maintained a substantially stable number of companies and employees in recent years, demonstrating the solidity and continuity of this strategic supply chain for Italian manufacturing. The sector, which has **225 active companies** and **exports worth €385 million**, is unique in Europe, having been created and developed thanks to close collaboration between machinery manufacturers and manufacturing companies. Starting in 2024, the Italian footwear, leather goods and tanning machinery industry will face a critical phase, confirmed by the first half of 2025, which saw a **12.8% decline in exports**. This decline is part of an unstable global context, characterised by conflicts, geopolitical and commercial tensions, and a review of supply chain processes in the fashion sector.

*"Our data shows a sector in decline, but the signals coming from the trade fair are partly reassuring, and we believe they are not just a flash in the pan," said Mauro Bergozza, President of Assomac. "The value of our industry's production, which has a **total turnover of around €650 million** and employs around 3,800 people, is the solid foundation on which our leadership can still rest. The figures from Simac Tanning Tech show that, in difficult times, companies and operators choose the fair to strengthen strategic relationships and present innovations for the future of the sector. Our event is not just a commercial space, but proof that Italian industry is resilient and capable of responding to challenges with concrete, innovative and sustainable solutions."*

This edition of Simac Tanning Tech offered a rich programme of events and debates on the most topical issues: Artificial Intelligence, sustainability, traceability, and European innovation projects in the sector. The protagonist this year was the African continent, which is increasingly strategic in terms of demand for industrial goods and cooperation aimed at strengthening the main industrial supply chains. Assomac hosted in-depth meetings on the African continent at the fair, with a **focus on Kenya**, involving the main institutions of both countries. This was an important dialogue aimed at strengthening the partnership, with the goal of promoting the competitiveness of Italian-made products and contributing to the **development of the leather and footwear supply chain in Africa**.



The strategic agreement signed between Simac Tanning Tech and Lineapelle is also fully in line with this vision of promotion, collaboration and development. The synergy between the two trade fairs, which bring together technology and materials under one roof, aims to offer an integrated platform that reflects the value chain starting from the fashion industry: this is essential, especially in light of the international commercial situation. “In the context of a market that continues to remain in a highly critical condition, LINEAPELLE has demonstrated its ability and strength to position itself as an indispensable forum for identifying, discussing and developing all possible new inputs and production and commercial paradigms,” said **Gianni Russo**, President of LINEAPELLE.



With this spirit of innovation and synergy, the conclusion of Simac Tanning Tech marks the beginning of a new cycle of activity for Italian companies in the sector. The trade fair, with its role as a promoter of technology and relationships, has proven to be the catalyst needed to address the challenges of an ever-changing market, providing useful tools for recovery.

LINEAPELLE

106th LINEAPELLE : Sharing, Innovation, Quality

1,150 exhibitors welcomed 21,433 professional visitors at the three day event.

LINEAPELLE has shown its ability and strength to establish itself as an indispensable forum for intercepting, discussing, and developing all possible new inputs and production and commercial paradigms that can lead to a season of revival

The 106th edition of LINEAPELLE the leading trade fair for the global luxury, fashion, and design manufacturing industry, held at Fiera Milano Rho, Milan, Italy, from 23 to 25 September 2025, and dedicated to the Autumn/Winter 2026/2027 season – once again confirmed itself as the ideal venue for meetings, discussions, and sharing across a supply chain that, with the quality of its creative offer, investments in product innovation, and expansion of services, welcomed a high-profile audience. Visitor numbers showed an inevitable, though expected, decrease, reflecting the negative economic climate and the impact of numerous external challenges affecting the fashion industry.

1,150 exhibitors welcomed 21,433 professional visitors at the three day event. Attendees came 59% from Italy and 41% from 109 countries, representing over 7,000 companies across the supply chain. These are solid figures, demonstrating creative dynamism, innovative drive, and vitality that provide reassurance despite the ongoing difficulties in the current economic scenario.

As a true laboratory of ideas and innovation, LINEAPELLE 106 engaged and stimulated its community through a series of projects and debates. Highlights included the ever-popular In The Making workshops, as well as appointments with AIMateriality and Lineapelle On The Road, initiatives offering in-depth exploration of the impact of Artificial Intelligence tools in fashion. On this occasion, LENA – the first virtual assistant by Lineapelle, developed in collaboration with Ingenium – Made in Italy Innovation Platform – was introduced. Significant interest was also generated by the talk on the relationship between sports and

LINEAPELLE

106 LINEAPELLE, MILAN 23-25 SEPTEMBER 2025





Source : <https://www.lineapelle-fair.it>

fashion, featuring ski champion Deborah Compagnoni, ambassador of the Milan-Cortina 2026 Winter Olympics and Paralympics. There was also strong participation in the series of scientific and regulatory seminars that examined the latest developments in the key challenges and issues facing the leather industry and its supply chain.

GIANNI RUSSO, PRESIDENT OF LINEAPELLE

“Three satisfying days, as highlighted by the majority of our exhibitors, despite a realistically expected reduction in visitors. In the context of a market still facing severe challenges, LINEAPELLE has shown its ability and strength to establish itself as an indispensable forum for intercepting, discussing, and developing all possible new inputs and production and commercial paradigms that can lead to a season of revival. This was made possible also thanks to the strengthening of the strategic alliance with the technology of Simac Tanning Tech, with which LINEAPELLE signed an agreement that projects the two exhibitions into a dimension of shared projects unparalleled in the industry for innovative vision and international outlook.”

MAURO BERGOZZA, PRESIDENT OF SIMAC TANNING TECH

“In a global market that constantly imposes new challenges, joining forces is the only way to remain competitive. The synergy between Simac Tanning Tech and Lineapelle, between technology and materials, represents a virtuous model for the entire Made in Italy sector. Working together allows us to strengthen our leadership and look to the future with confidence, promoting a supply chain vision that goes beyond the supply chain itself and beyond individual markets.”

LOOKING AHEAD TO FEBRUARY

The next edition of LINEAPELLE, dedicated to the Spring/Summer 2027 season, will take place from 11 to 13 February 2026, once again in Halls 1-3, 2-4, and 5-7. This is due to the simultaneous hosting of several competitions of the Milan-Cortina 2026 Winter Olympics at Fiera Milano Rho.



The European leather industry met in Milan at Lineapelle in the COTANCE Council held on 25 September 2025.

Under the Presidency of **Manuel Rios** (INPELSA, Spain), **Fabrizio Nuti** (Nuti-Ivo, Italy) and **Jean Christophe Muller** (Tanneries Haas, France), delegates from **UNIC** (IT), **ACEXPIEL** (ES), **FFTM** (FR), **VDL** (DE), **LeatherUK** (UK) and **APIC** (PT), welcomed the European Commission's announcement to postpone the entry into application of the EU Regulation for Deforestation-free supply chains (EUDR) by one additional year.

COTANCE calls on the European Commission to take advantage of the postponement for finally releasing the Impact Assessment of EUDR Article 34 and to use the delegated act for removing hides, skins and leather from the scope of the Regulation. Indeed, hides, skins and leather should never have been listed in the scope of the EUDR, as it is evidenced in the Study of the Sant'Anna Institute of the University of Pisa that leather is not a driver of deforestation.

COTANCE also urges the European Commission, the Council and the European Parliament to proceed to a substantial simplification of the EUDR through an Omnibus package, in order to ensure that only products which are real drivers of deforestation fall into its scope and that 0 to low risk countries don't have to provide geolocation-based traceability and/or that only the first placing on the EU market had to fulfil a due Diligence Statement.

European Leather Industry calls for swift ratification of the EU-MERCOSUR partnership agreement

26 European business associations are urging the rapid ratification of the EU–Mercosur Partnership Agreement, underlining its importance for Europe’s industrial competitiveness, trade diversification, and sustainable growth.

The joint declaration, endorsed by a broad coalition of European industries, highlights that the EU–Mercosur Partnership represents a strategic opportunity to deepen economic and political ties between two regions that together account for one-fifth of the global economy and a population of over 750 million people. In an increasingly fragmented global trade environment, this agreement stands as a clear commitment to openness, cooperation, and shared prosperity.

Joint Declaration

Trade relations between the EU and Mercosur are already substantial, with total exchanges in goods and services reaching €153 billion in 2024 and mutual investment amounting to €380 billion in 2023. According to European Commission estimates, the agreement could add €77.6 billion to the EU’s GDP by 2040, while EU exports to Mercosur are expected to rise by 39%, with Mercosur exports to Europe increasing by 17%. These figures illustrate how a modern, balanced trade framework can drive competitiveness while ensuring that high social and environmental standards remain integral to economic progress.

For Europe’s leather industry, the agreement offers a significant opportunity to improve the access to necessary resources,

strengthen cooperation, and build more resilient, sustainable supply and value chains.

Beyond trade, the EU-Mercosur Partnership Agreement embeds robust commitments to sustainable development, including action on climate change, biodiversity protection, and labour and social rights. It will provide a framework for responsible trade that supports Europe's Green Deal and Circular Economy objectives, while preserving sensitive sectors and promoting high-value industrial cooperation.

COTANCE joins its partners across European industry in calling on the Council of the European Union and the European Parliament to move forward swiftly with the ratification of both the EU-Mercosur Interim Trade Agreement (ITA) and the EU-Mercosur Partnership Agreement (EMPA). Ratifying this agreement is not only a step toward stronger international partnerships-it is a vital investment in Europe's industrial resilience, competitiveness, and sustainable future.



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APLF Report: Factors Driving Leather Imports in ASEAN

In anticipation of the upcoming APLF ASEAN Vietnam trade fair, which will take place from November 13 to 15 in Ho Chi Minh City, APLF Ltd., the organizer, has prepared a detailed report on the sectors and products required by some of the region's largest importers.

The data details the key factors driving demand for imported leather in ASEAN countries:

- **Growing middle class:** As incomes rise, so does the demand for premium and branded leather goods, especially in urban centers.
- **Growing footwear and apparel industries:** ASEAN is a global hub for footwear and apparel manufacturing, requiring a consistent, quality supply of leather.
- **Expanding automotive sector:** The proliferation of car owners and assembly plants increases demand for quality automotive leather for seats and interiors.
- **Tourism and hospitality:** Growth in the hospitality and catering industry is generating increased demand for leather furniture and furnishings.
- **Insufficient local supply:** Not all countries have sufficient livestock or tanning capacity to meet domestic demand, making imports essential.

Major ASEAN Leather Importers

Among ASEAN countries, four countries stand out as the top leather importers: Vietnam, Indonesia, Thailand, and Malaysia. Their import patterns, key trading partners, and market drivers are analyzed in detail below.

Vietnam

Vietnam has rapidly established itself as a global manufacturing powerhouse, particularly in footwear and leather goods. Major

international brands such as Nike, Adidas, and Puma have established production bases in the country, boosting demand for high-quality imported leather.

- **Import Profile:** Vietnam imports substantial quantities of raw hides, wet-blue leather, and finished leather, primarily for footwear and fashion accessories.
- **Key Suppliers:** The main suppliers are the United States, Brazil, Italy, South Korea, and India.
- **Industry Focus:** More than 1,500 footwear factories operate in Vietnam, primarily in the south, generating a strong and consistent demand for leather imports.
- **Trends:** Vietnam's imports are characterized by growing demand for sustainable and traceable leather, driven by the requirements of global fashion brands and export market regulations.

Indonesia

Indonesia's leather sector caters to both domestic consumption and export-oriented manufacturing. The country's large population and thriving middle class support strong demand for leather goods.

- **Import Profile:** Imports raw and finished leather, with an emphasis on hides for processing and finished leather for footwear and upholstery.
- **Key Suppliers:** Australia, the United States, and Italy are among the top suppliers.
- **Industry Focus:** The footwear industry is a major driver, along with the furniture and automotive sectors.
- **Trends:** There is growing interest in innovative and sustainably processed leathers due to environmental concerns.

Thailand

Thailand is renowned for its high-quality leather manufacturing, which supplies both the export and domestic markets. The country also acts as a regional hub for luxury goods and automotive assembly.

- **Import Profile:** Thailand imports wet-blue, crust, and finished leather, as well as specialty leathers for the automotive and haute couture sectors.
- **Key Suppliers:** Import sources include Italy, the United States, and China.
- **Industry Focus:** Thailand's leather sector is diversified, with significant activity in footwear, handbags, automotive interiors, and furniture.
- **Trends:** Demand for luxury and branded leather goods is increasing, with rising imports of exotic leathers for the high-end market.

Malaysia

Malaysia's role as a major importer is supported by its developed manufacturing sector, strategic location, and strong export relationships.

- **Import Profile:** It imports raw, wet-blue, and finished leather to supply its domestic manufacturing sector.
- **Key Suppliers:** The United States, Australia, and Brazil are its main suppliers.
- **Industry Focus:** The country's industries include footwear, automotive upholstery, and high-quality apparel.
- **Trends:** Emphasis is placed on sourcing premium leather and adopting environmentally friendly processing technologies.

To take advantage of the opportunities offered by the ASEAN region, participate in the APLF ASEAN Vietnam, taking place from November 13 to 15 in Ho Chi Minh City.

Contact us at: info@aplf.com

Source : cueroamerica

Erasmus+ Shoe 5.0 Brings Industry 5.0 to Footwear

The Erasmus+ Shoe 5.0 project brings together seven partners (industry, education, and technology actors) from Portugal, Spain, Romania, Italy, and Belgium with a common goal: to equip the European footwear sector with the skills needed to embrace the transition towards a sustainable, human-centric, and resilient footwear industry, one that goes beyond efficiency and productivity to create real added value.

For this purpose, the consortium has developed a wide range of online learning resources designed for footwear companies, future professionals, and educators. These resources are available in English, Romanian, Italian, Portuguese, and Spanish, and focus on five key profiles within the sector:

♦ Footwear Technical Manager ♦ Footwear Manufacturing Operator
♦ Footwear Designer/Pattern Maker ♦ Maintenance Technician ♦ i5.0 Footwear Architect – a newly defined profile that integrates the skills, knowledge, and attitudes required by Industry 5.0.

Learners can start by using the Shoe 5.0 Scanning Tool, which generates their personalised training plan. The Training Programme, hosted on the project website, includes 15 modules with presentations, infographics, and videos. Each module corresponds to 100 hours of studies and aligns with EQF level 5 or 6. Furthermore, there is a mobile app (for Android and iOS) featuring an augmented reality (AR) educational game linked to each module that complements the programme. A dedicated training manual for trainers is also available, helping them better support trainees throughout the learning journey.

Beyond training, the project has produced several studies, including:

♦ A report on how Industry 5.0 can apply to the European footwear sector. ♦ An analysis of the key workforce profiles required for the industry's future. ♦ A study on customised training plans tailored to different skills and learning needs.



Back to School Column

Dr N K Chandra Babu

Chrome Tanning - Part II

In the last column, an attempt was made to highlight aqueous chemistry of chromium (III) which enables it to function as a good tanning material. The ability of Cr (III) metal ion to form complexes of intermediate size and stability is considered as an advantage over other transition metal ions which have been screened for the purpose of tanning. For examples, iron tanning which was discovered at the same time as Chrome tanning, did not make much headway as a tanning system due to high acidity of the metal ion {Fe (III) with d_5 electronic configuration} which tends to polymerize to high oligomers with relatively poor stability. The tanned leathers are dark brown in color which becomes even darker on aging with patches many times. High acidity makes the tanned leather with poor strength properties and aging characteristics. The tendency of iron to form grey to blue to black coloration with vegetable tannins is another disadvantage. Zirconium (IV) and Aluminium (III) (not truly a transition metal ion) are the only other metal ions commercially exploited to some extent, but not as self tanning materials. With no electrons in d orbitals (d_0 electronic configuration), they do not form stable crosslinks like chromium with lower hydrothermal stability but the tanned leather is white in colour. Zr(IV) tends to form highly solated/oxolated complexes even in acidic pH condition and hence there is a need for employing very low pickle pH to get sufficient diffusion and this coupled with extensive polymerization makes the tanned leathers with poor grain characteristics, though the leathers are fuller, akin to vegetable tanned leathers. Both Al(III) and Zr(IV)

metal ions are usually heavily masked with chelating ligands with hydroxy carboxylic acids to stabilize them to some extent against extensive hydrolysis.

An introduction to mechanistic aspect of chrome tanning has also been made with a plan to deal with the same in a detailed manner in this column.

Composition of Basic chromium (III) sulfate tanning agent

The preparation of 33% basic chromium sulfate (BCS) used in tanning has been briefly outlined in the last column. Basification by increase in pH is essential for enhancing chromium reactivity and uptake during tanning. The tanning salt is not a single well defined molecule but contains many chromium complex species varying both in size and charge characteristics. As mentioned earlier, dimer, trimer and tetrameric chromium species and other high oligomeric species (also commonly expressed as bi, tri and tetra nuclear complexes respectively with chromium being joined through mainly hydroxo bridges) are quite common and the presence of some nonionic and anionic chromium complexes is also not uncommon with other anionic ligands like sulfate and organic anions containing carboxyl groups (mainly organic acid intermediates formed when glucose/molasses is used as reducing agent) entering the chromium complexes. The degree of polymerization of chromium complexes increases with the basicity, but with varying extent depending on the reaction conditions. Many researchers have isolated and characterized many species from the chrome liquor. The pioneering work of Indubala and Ramaswamy in this regard is worth mentioning. There have been many review articles including a comprehensive paper by Ramasami et al detailing the structure of chromium (III) species in tan liquors. About 15 species of chromium complexes are

reported to be present in BCS. The composition of the tan liquor may vary depending upon the nature of reducing agents used and the reaction conditions employed including the mode of addition of reactants (both order and rate of addition) during the manufacture of BCS. The tanning salt apart from having a soup of chromium complexes, contains neutral salt, sodium sulfate as well in considerable amount, which is formed during the reduction process (Pl. refer the equation pertaining to the reaction in Part I). The chromium content in BCS is analyzed and expressed conventionally as chromium oxide (Cr_2O_3) which is usually 25% on the total dry weight (that is the maximum theoretical value possible, unless or otherwise, an effort is made to remove sodium sulfate from BCS). In fact, many commercial BCS salts available commercially do contain less than this amount of Cr_2O_3 content.

Rationale behind the current commercial practice of chrome tanning

The commercial practice of chrome tanning is well evolved and a time-tested one with sound scientific basis taking into consideration the reactivity of both the substrate and chromium complexes and hydrolytic characteristics of Cr (III) in aqueous solutions at different pH conditions. The reactivity of chromium (III) complexes in BCS with skin matrix in general and collagen in particular was outlined earlier in the article on 'Structure and reactivity of collagen'. The charged side chain carboxyl groups from the aspartic and glutamic acids are believed to be mainly involved in reaction with chrome tanning complexes by forming coordinate covalent linkages. Some amount of hydrogen bonding with the peptide groups all along the backbone chains in collagen (Covington) and electrovalent linkage between cationic chromium complexes and anionic functional groups in collagen (Ramasami) are also possible but they may not

contribute significantly to stability of the tanned leathers. Type 1 collagen contains about 4.5 and 7% aspartic and glutamic acid residues respectively. Complexation is a special type of covalent bond in which the pair of electrons needed for bond formation comes from oxygen in charged carboxyl group and the electrons are shared between chromium (III) and carboxyl groups. Since the carboxyl groups should be in ionized form to facilitate this complexation reaction, pH is a critical parameter. The pH is critical from the chromium complexes point of view as well, as it can have a profound influence on the basicity, polymerization and solubility of chromium. Hence, the pH range during tanning has been carefully chosen taking into consideration the pKa of aspartic and glutamic acid residues as well as the stability of chromium (III) complexes. The pKa of side chain carboxylic acids in collagen is reported to be in the range of 3.4-4.4. Hence, in commercial practice, chrome tanning is commenced below pH 3.0 to make sure majority of carboxyl groups are in unionized form so that rapid reaction with chromium does not take place leading to surface fixation, which might block further diffusion of chromium complexes inside the matrix to achieve uniform tanning. From chromium complexes point of view also, it is ideal to start the tanning at pH below 3.0 as higher pH conditions will lead to higher basicity which results in increased polymerization with decreased solubility and poor diffusibility and high reactivity leading to surface deposition/fixation with poor distribution across cross section. For good tanning, it is necessary to ensure good diffusion of chromium well into interstices and uniform distribution across cross section before complexation reaction can take place. Otherwise, the quality of resultant wet blue leathers will not be good with the leather behaving very poorly during splitting and shaving (the fibres having poor chrome uptake tending to cringe/burn), and loss of area in the final finished leathers many times.

Ideally, a uniform pH of 3.0 is to be achieved across cross section by a well designed pickling process to ensure quicker penetration and uniform distribution of chromium. Sufficient salt concentration is critical to avoid any acid swelling in pickling (by use of 2N NaCl (6-7 Be°) solution) before addition of acid. Even slight swelling if any, will make it difficult in achieving uniform pH across. Complete deliming is also necessary especially with thicker substrates. Any inner layer with streak of lime will result in the formation of sparingly soluble calcium sulfate (by reaction with sulfuric acid commonly used in pickling), which will act as a barrier for diffusion of acid, thus preventing the achievement of uniform cross section pH, even with bath pH being very low. This will lead to poor penetration of chromium subsequently and consequently to poor quality of wet blue leathers produced. This will be illustrated by a case study in the next section.

Once chromium is distributed uniformly across cross section, the basification is commenced with a mild alkali (commonly sodium bicarbonate) (after ensuring sufficient float) in combination with buffering base like sodium formate to a final pH of 3.8. The increase in pH results in increasing number of charged side chain carboxyl groups being available for reaction with chromium on one hand and increase in basicity of chromium leading to increased reactivity on the other. But pH has to be gradually increased carefully not to cause sudden spurt in basicity which might result in non uniform uptake of chromium leading to dark color of wet blue and chrome patches in worst cases. That is the reason for using a mild alkali like sodium bicarbonate in combination with a buffering salt like sodium formate or acetate. These mild alkalis are also dissolved well in water (poor solubility of bicarbonate) and added in many feeds to ensure good tanning. Higher basification pH above 4.0 invariably

leads to dark colored tanned leathers and piece to piece color variation in a batch of leathers with chrome patches in worst scenario as the basicity can shoot up above safe limits to cause precipitation of chromium. One report talks about the basicity being kept about 45% in the entire duration of basification.

Masking agents are often used in tanning to moderate the reactivity of chromium on one hand and increasing the precipitation pH on the other. Organic complexing anions such as formate and acetate are often used for the purpose in chrome tanning. Thus sodium formate/acetate can play dual role by functioning as masking and buffering agent

Even after achieving uniform basification pH of 3.8 across cross section, it is necessary to continue tanning for sufficient time to ensure fixation of chromium. Thicker the substrate, more should be the running time. This assumes importance considering the fact that chromium reacts very slowly owing to its kinetic inertness. In commercial practice, it is ensured by conducting a boil test (min of 2 min). Sufficient hydrothermal stability can be built not by simple unipointal fixation of chromium only but by the formation of intermolecular/interfibrillar crosslinks through bipointal/multipointal fixation of chromium. This will be discussed further in the section on mechanistic aspects.

A case study which emphasises the need for good pretreatment prior to chrome tanning

As promised in the last section, a case study is presented here to stress on the importance of good pretreatment (especially thorough deliming) prior to tanning especially with thicker substrate. Once, this author was contacted by one of the large wet blue buff leather producer for technical advice and consultancy. The tanner was

producing wet blue leathers from heavy buffalo hides with over all thickness of more than 10 mm in neck and butt regions for one of the largest footwear producer/retailer in the country. The client was sourcing such thick substrate to enable him to get at least 2 good splits apart from the grain-on main layer. Hence, he was insisting that the leathers after tanning should stand 3 min boil test. To ensure this, the client had placed his quality control personnel at the tannery so that the tanner does not finish tanning without the leathers standing boil test. But the tanner was finding it difficult to achieve the boil test requirement of the client and the author was called in to advice him in this regard. At the time of arrival of the author at the tannery, pickling for a lot was going on and it was observed that a uniform pickling pH of 2.5-3.0 at cross section was not achieved though the bath pH was very low despite running for several hours. In the evening, the pelts were left in pickle bath overnight as per usual practice. Next day, after running for one hour, the pH was checked and there was still an inner layer at pH above 4.5 especially in butt and neck portions. Obviously, because of the thick substrate being processed, complete deliming was probably not achieved leaving a streak of lime in the middle. This has resulted in the formation of calcium sulfate during pickling which was acting as an impervious layer preventing diffusion of acid despite the bath pH being close to 1.0. Though, the tannery was using formic acid along with sulfuric acid, it is not much of use in solubilizing and clearing the calcium sulfate barrier. Hence a stronger remedy was felt necessary and it was decided to use hydrochloric acid to solubilize calcium sulfate by converting that into soluble calcium chloride. On my advice, 33% hydrochloric acid was procured and the use of about 0.5% Hall did the trick and it was possible to get uniform cross section pH within a short duration. Then chrome tanning was commenced and the penetration of chrome was achieved in less

than 3 hours all over and the entire tanning including the basification was completed in 8 h duration with a final pH of 3.8 at cross section. The leather produced stood boil test to the satisfaction of the client's representative. The quality of the leathers was also good with uniform pleasant colour. Next day, the work was continued with a fresh lot of pelts to standardize deliming process to achieve good tanning in shorter duration. As the pelt was very thick, the tanner was using almost 8% ammonium sulfate. It was decided to carry out deliming in 2 stages with ammonium chloride. In the first bath, 3.5% ammonium chloride with 0.3% sodium bisulfite was used and the drum was run for 2h. Then in fresh bath, deliming was continued with 2% ammonium chloride for 1h after which the completion of deliming was checked. Still a thin layer was found to be not neutral to phenolphthalein. Now, 0.3% HCl was used in 3 feeds after the addition of 3% common salt. After 30 min of running time, the deliming was complete with cross section at thick and compact regions of neck and butt becoming completely neutral to phenolphthalein. Then pickling was continued after washing of the delimed pelt. The salt concentration of the pickle bath was adjusted to 7 Be° by the use of sufficient amount of common salt before addition of formic acid and sulfuric acid. Pickle pH of 2.5 across cross was achieved in 2h of running time and the drum stopped and left overnight. Next day after running for 30 min, the cross section pH was checked (found to be uniform) and chrome tanning was continued as usual. Good diffusion of chrome was easily achieved and the wet blue leather standing boil test after basification to a uniform cross section pH of 3.8. As per the assessment of the tanner as well as client's representative, the wet blue leathers had uniform colour with least piece to piece variation as well between grain and flesh sides. The grain characteristics of the leathers were also found to be improved with smooth fine grain almost resembling that of cow

hides (as per the tanner's observation). The ultimate feedback from the buyer in terms of the behavior of the leathers during splitting and buffing, quality of splits and reduced area loss when the finished leathers were made from grain layer and two splits.

This case study clearly illustrates the need for thorough deliming and pickling to get good quality chrome tanned leathers especially with thicker/heavier substrates. (However, caution has to be exercised if HCl is to be used in deliming. It is not recommended to use it in the first deliming bath as it might cause acid shock on one hand and liberation of toxic hydrogen sulfide on the other. The above process was carefully designed with two bath deliming process with use of bisulfite/metabisulfite in the first bath to eliminate residual sulfide to ensure the pelt being almost free from sulfide. Salt was also used in the second bath before the addition of HCl in feeds to avoid acid swelling if any)

Mechanistic aspects related to chrome tanning

When one talks about the mechanism of tanning, there are two important aspects to be considered and these aspects are not completely unrelated to one another. One aspect is how the tanning materials impart resistance against bacterial degradation. Other aspect is the mechanism of reaction between the tanning material and the skin protein imparting stability and enhanced hydrothermal resistance. Various theories in vogue to explain the important aspect pertaining to how tanning imparts resistance against bacterial resistance have been adequately discussed in the last article. A part of the discussion is included here as well for the sake of completion and continuity.

The mechanism by which various tanning systems impart resistance against bacterial degradation is not well understood though many theories have been put forward by researchers to explain this. The most logical explanation is that the tanning materials bring about changes in the substrate either at molecular level or at microstructure or macro levels such that bacteria or the enzymes secreted by them do not recognise the substrate any more but the method through which they achieve this may be unique to each one of them. Some of the mechanisms proposed include cross linking which bring about long range order in the tertiary and quaternary structure of collagen fibrous network, deposition and fibre coating with effective blocking of active sites in the collagen supramolecule prone for attack by bacteria, reduced availability/accessibility of hydrophilic functional groups due to reaction with tanning materials, even tanning materials acting as biocides against bacteria. Cross linking leading to high hydrothermal stability is considered important but this cannot explain bacterial resistance in oil tanning with which there is no increase in hydrothermal stability.

Mechanism of chrome tanning with respect to crosslinking leading to high hydrothermal stability

Before discussing about this aspect, due credit should be conferred on Dr Ramasami and Dr Tony Covington who contributed significantly to the current understanding of mechanism of chrome tanning. I was fortunate enough to be present during the ALCA congress in USA when Ramasami presented Arthur Wilson Memorial Lecture on his Unified Theory of Tanning, which was received well with standing ovation. It was a proud moment indeed for his ardent student like me. Those who want to gain deeper understanding of

chemistry of chrome tanning are advised to refer many of the research papers from these two scientific stalwarts.

Let us now continue our discussion about the chemical reaction between chrome and collagen responsible for fibre stabilization resulting in enhanced hydrothermal stability in detail. Hydrothermal stability is usually measured in terms of shrinkage temperature (T_s) in leather industry. Among the various tanning methods, the highest shrinkage temperature ($> 110^\circ \text{C}$) is achieved only with chromium. In fact, chrome tanning is the only solo tanning system capable of producing boiling water stable leather. Obviously, the reaction between Cr(III) and functional groups present in collagen supermolecule bringing about structural changes in the substrate should be responsible for such an improved hydrothermal stability. Various possible reactions between chromium and collagen are

- Coordinate covalent reaction between chromium and chain carboxyl groups (mainly side chain carboxyl groups from aspartic and glutamic acid residues)
- Electrovalent interactions between cationic chromium complexes and anionic functional groups in collagen (again major contribution from charged side chain carboxyl groups)
- Hydrogen bonding between chromium species and polypeptide chains.

Hydrogen bonding and electrovalent interactions though possible, they alone cannot explain such an enhanced hydrothermal stability observed and hence complexation reaction involving stronger coordinate covalent bonding assumes greater importance. But single point bond (often referred to as unipoint fixation) alone cannot

contribute to such a huge structural stability. High T_s is explained as due to di and multipoint fixation of chromium with side chain carboxyl groups by complexation reaction forming intermolecular/interfibrillar crosslinks. But it has been convincingly shown through systematic studies that crosslinks formed during chrome tanning are mostly intact after shrinkage and only intermolecular hydrogen bonds are broken/cleaved during the shrinking process. In the light of these findings, only way to explain the high hydrothermal stability is that crosslinks bring about structural changes in the collagen super molecule restricting the accessibility to intermolecular/interfibrillar hydrogen bonds during the shrinkage process. Gayathri, Ramasami et al has confirmed long range ordering in collagen supermolecule involving tertiary and quaternary structure level organization.

In practice, this concept has been put to use by the author to produce wet blue leathers which stand boil test for more than 1h by the use of suitable multi-dendate ligands as additives in tanning, which has helped to further stabilize chrome tanning by imparting a hydrophobic fibre coating. Such high heat resistance is desirable in the case of oil seal and stropping leathers (used for sharpening shaving razor blades) and mountaineering shoe uppers to some extent (conventionally achieved by increasing chromium content in leather with some standards stipulating 5% Cr_2O_3). Same concept was used to produce boiling water stable Fe(III) tanned leathers with improved aging characteristics and strength properties.

The pollution related issues related to chrome tanning will be dealt with at a later date.

For any feedback, please mail to babunkc@yahoo.com



STAHL REOPENS FACILITY IN RANIPET, INDIA: A STRATEGIC STEP TOWARDS SUSTAINABLE GROWTH AND INNOVATION

Stahl, the global leader in speciality coatings for flexible materials, proudly announces the reopening of its advanced coatings facility in Ranipet, India. This milestone marks a significant step in Stahl's transformation journey and reinforces the strategic importance of its presence in India, one of the world's largest and fastest-growing economies.

The reopening reinforces Stahl's commitment to innovation, sustainability, and customer collaboration through locally produced, high-performance speciality coatings. Originally inaugurated in April 2000, the Ranipet facility remained operational until its closure in 2019. Following Stahl's recent announcement of the divestment of its wet-end activities, it has officially reopened the site with a future focused on leather finishing, performance coatings, and packaging coatings.

The upgraded Ranipet facility brings together coatings formulations production, R&D, and application lab & testing capabilities - all under one roof. This comprehensive setup accelerates development cycles, strengthens customer collaboration, and enables Stahl to co-innovate with partners. With the enhanced innovation lab, the company can respond swiftly to evolving market needs and scale operations in line with growing demand, driving innovation from within the region. Stahl shall continue to further strengthen its capabilities – Manufacturing, R&D and Application, at the Ranipet facility in accordance with market needs and opportunities.

A hub for innovation and growth

India's position as one of the world's largest and fastest-growing economies makes local production a key strategic advantage for Stahl and its customers. The reopening of the Ranipet facility strengthens Stahl's footprint in India, aligning with its customer-centric 'local for global' business model.

India is a key growth market across all three of Stahl's business segments, and the enhanced capabilities of the site enable the company to serve both regional and global customers with greater proximity, agility, and impact.

"The reopening of our Ranipet site is an important milestone in Stahl's transformation journey," said Maarten Heijbroek, CEO of Stahl. "This investment reflects our strategic focus and aligns our capabilities with future market demands. Being able to produce locally in India - an essential growth market - strengthens our position and enables us to better support our customers with tailored, innovative solutions."

A modern facility for a sustainable future

Equipped with the latest technology and automated systems, this future-proof facility is fully compliant with environmental and safety regulations. It features a state-of-the-art wastewater treatment system that recycles all process water, resulting in zero liquid waste-positioning the facility as ideal for sustainable and future-ready manufacturing. With around 140 employees on-site-many of whom have been with Stahl since the early 2000s-the reopening also represents a return home. Their loyalty, expertise, and energy will be instrumental in ensuring the success of the site's next chapter.

"Ranipet has always been a special place for Stahl, and its reopening is both a homecoming and a new beginning," added Ranganath BV, Managing Director – India & Bangladesh. "Our dedicated professionals have the expertise and passion to drive customer success both in India and worldwide. This modern, sustainable facility strengthens our ability to serve customers locally while contributing to Stahl's global innovation journey."

Looking ahead

The reopening of the Ranipet facility represents more than a return-it reflects Stahl's long-term commitment to innovation, customer proximity, and strategic growth across India and beyond. With its modern infrastructure and highly skilled workforce, the Ranipet facility is set to play a pivotal role in delivering sustainable, high-performance products, while reinforcing Stahl's presence in this vital growth region.



New TFL Colour Trends Spring-Summer 2027

TFL has released its new catalogue for Spring-Summer 2027, presenting the latest colour trends for leather garments, footwear, accessories and for the upholstery industry.

The trends are divided into “**Wearing**” and “**Living**”.

“**Wearing**” comprises inspirations and colour trends for garments, footwear and accessories.

The “**Living**” section features all colours that will decorate the season’s interior designs.

In the “**Wearing**” section, fashion and design embrace bold contrasts and natural inspiration. The negative reptile print makes a comeback in striking greens and lemon yellow. Boat shoes dive into a spectrum of sea blues and reflection of the open sky, while suede takes on sandy neutrals combined with pop colours inspired by fruit ice creams.

In the “**Living**” section, sofas and armchairs light up in vibrant camellia pinks for dynamic environments with character or opt for timeless elegance with taupe and earthy browns.

TFL Colour Trends **Spring-Summer 2027** are an invitation to explore tactile and visual emotions through colour, combining innovation, comfort and style.

The TFL Colour Trends catalogue is available now.

For more details, please visit www.tfl.com.



BASF Care Chemicals announces the second Care 360° Sustainability Days

- **Live on Screen: Care 360° Global Sustainability Days from November 11 to 13, 2025**
- **Global customers from Personal Care, Home Care, I&I, and Industrial Formulators are invited to explore industry-relevant sustainability topics and identify opportunities to generate value.**
- **With four different sessions led by sustainability professionals and industry experts, the Care Chemicals division wants to collaborate with customers to achieve fundamental sustainability goals.**

BASF's Care Chemicals division is hosting its second Care 360° Sustainability Days event, which will take place from November 11 to 13, 2025. Following the success of the first event, which focused on the European market, this year's event is aimed at customers from all over the world, with the ambition of exploring sustainability topics and opportunities in various industries.

"We are delighted to extend this innovative event format to all Care Chemicals customers worldwide. Only by working collaboratively can we actively shape a sustainable future," explains Dr. Matthias Maase, Director Global Sustainability, Care Chemicals, BASF. "We develop solutions with beneficial impact on the environment and society that meet evolving consumer and market demands."

The Care 360° Global Sustainability Days will begin with a cross-industry session exploring how renewable carbon solutions,

adaptable chain-of-custody models, and solid data standards can support customers in achieving their climate goals. Attendees will learn how Product Carbon Footprints (PCF) and data exchange frameworks turn ambition into concrete action and will get an overview of the latest carbon accounting methods to guide clear, confident net-zero strategies.

The industry-specific sessions will address topics relevant to the individual business areas of Care Chemicals. Personal Care will focus on the integration of sustainability as the new baseline and how the business unit supports its customers in achieving outstanding cosmetic performance or sensorial excellence at the same time.

For Industrial Formulators customers, BASF will discuss the relevance of the product carbon footprint (PCF), its precise calculation, and the communication of this data. Participants will learn how digitalization enables reliable, automated data and facilitates access to information for customers.

A dedicated session for the Home Care and I&I Cleaning industries will demonstrate how sustainability is integrated from creating molecules to designing and developing formulations.

The session will cover core sustainability topics, including biodegradability, product carbon footprint, and labelling, and will illustrate practical implications for product development and market positioning.

All sessions will be held in English and broadcasted live from BASF's Customer Experience Center in Ludwigshafen. Participants are invited to join virtually and ask questions.

Below is the link to register:

<https://care360.basf.com/global/en/sustainability/sustainability-days-2025>

38th IULTCS Congress closes in Lyon



The 38th congress of the International Union of Leather Technologists and Chemists Societies (IULTCS) came to a close in Lyon on September 11, with more than 200 delegates attending two and a half days of presentations. By Leatherbiz.

The programme reflected the theme, “Beyond leather tradition, innovation and sustainability”, covering topics from traceability and beamhouse operations to chemical compliance, finishing, waste and water management, life cycle assessment and regulatory developments, as well as the growing focus on valorisation of tannery wastes and by-products, all aimed at reducing environmental impact while maintaining leather’s value.

Closing the congress, IULTCS president Dr Juan Carles Castell told participants: “In the end, solutions must be based on natural materials, be value-based, and have minimal environmental impact. Your knowledge and your passion ensure the sustainability of the leather industry.”

He also took the opportunity to welcome the incoming president, Dr Geoff Holmes, who will begin his term on January 1. The next IULTCS congress will take place in 2027 in León, Mexico. (aplif.com)

Leather Auxiliaries – A Review PART – III

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(Contd. from September issue)

3. Clean Technologies Concept

The European Commission defined clean technologies as follows:

Clean technologies are new industrial processes or modifications of existing ones intended to reduce the impact of production activities on the environment, including reducing the use of energy and raw materials.

To support the definition the main attributes of clean technologies were precisely formulated:

Conservation of raw materials, Optimization of production processes, Rational use of raw materials, Rational use of energy, Rational use of water, Disposal or recycling of unavoidable waste,

Accident prevention, Risk management to prevent major pollution, and Restoring sites after cessation of activities.

UNIDO continues to place an emphasis on the introduction of cleaner leather processing technology in developing countries.³

The primary task of all cleaner technologies is to reduce the amount pollution emissions; and where possible change the nature of pollution emissions to reduce the pressure and costs of end-of-pipe treatment.

3.1 The expected results from cleaner technologies primarily include

The expected results from cleaner technologies primarily include:
Table – 3 A

- Lower water consumption – better preservation of rapidly diminishing water resources.
- Lower total dissolved solids (TDS) content (including salinity) – lower risk of affecting the usability of the receiving water bodies for irrigation and livestock watering.

The expected results from cleaner technologies primarily include:
Table – 3 A

- Avoidance of use in processing and/or presence in leather of substances from the Restricted Substances Lists (RSL) promulgated by national or regional legislation, leading (multinational) brands and/or ecolabel due to their proven negative impact on human health and eco-systems.
- Proportionally higher volume of solid wastes suitable for processing into saleable by-products.
- Lower levels of BOD, COD and Nitrogen; their respective contents in conformity with local and widely prevailing legislative norms.
- Low level of chromium in (C) ETP sludge – the scope for land application and/or composting.
 - Lower hazardous and/or unpleasant air emissions.
- Appropriate occupational health and safety (OSH) standards – better work conditions, fewer accidents.

Reference : 3. & Table 3 A Cleaner Technologies, 2018 leatherpanel.org

4.CLEANER TECHNOLOGIESAT A GLANCE

CLEANER TECHNOLOGIESAT A GLANCE Table – 4 A	
Category/ Process stage	Cleaner methods
EMS	A licensed or own Environmental Management System, incorporating OSH and Corporate Social Responsibility (CSR) in place
General	
Water	Strict water monitoring/control and savings measures at process, department and company level; batch washing, recycling
Energy	Usual consumption/savings measures combined with the energy from renewable sources, heat pumps, etc.

CLEANER TECHNOLOGIES AT A GLANCE Table – 4 A	
RSL	Apply the global strictest Restricted Substances and SVHC lists and avoid any limitations and risks in exports of leather and leather products
OSH	Strict segregation of acidic and sulphide containing streams, H₂S monitors in place, staff trained. Noise, vibrations, malodour control; appropriate lighting and ventilation, sanitary facilities. Occupational Safety and Health measures, general and personal (Personal Protection Equipment, PPE), including rigorously implemented and observed training
Beam House	
Preservation/ Soaking	Green fleshing Biodegradable surfactants Watch for harmful pesticides
Liming	Hair-save liming Consider reuse of liming liquors Ex-lime splitting
Deliming	Low- or ammonium-free deliming (CO ₂) deliming
Bating	Low- or ammonium-free bating agents
Tanyard	
Pickling and (chrome) tanning	Low-salt pickling Consider pre-tanning (wet white tanning) One or a combination of better chrome management systems • optimization of process parameters • high exhaustion • direct recycling of spent bath • reuse after chrome recovery Use of acceptable fungicides
Wet Finishing	
Retanning	Use of acceptable retanning agents (phenol- and formaldehyde-free) Use of low salt retanning agents' High exhaustion rate Careful selection of auxiliary agents

CLEANER TECHNOLOGIESAT A GLANCE Table – 4 A	
Dyeing	Avoidance of banned dyes Use of dedusted dyes High exhaustion rate Careful selection of auxiliary agents
Fatliquoring	Strict avoidance of halogenated (AOX) products High exhaustion rate Careful selection of auxiliary agents
Finishing	
Coating	Control of airborne particles/dust Use of water-based finishing systems Avoidance of harmful cross-linkers Avoidance of pigments containing banned/restricted metals Coating by advanced spraying equipment (airless, HVLP guns, scrubbers); curtain and roller coating
Solid Waste	
Consequent segregation of different waste categories, innovative approach in utilization and safe disposal	
Effluent treatment	
On-site pre-treatment and full scale (biological) on- or off-site treatment; compliance with local discharge norms	

Reference : Table – 4 A. The framework for sustainable leather manufacture, Second edition - Jakov Buljan, Ivan Kral' - 2019 the United Nations Industrial Development Organization

5. Green Chemistry ⁵

In simple terms, Green Chemistry is maintaining environmentally sound practices through the lifecycle of a chemical product (design, manufacture, use and ultimate disposal) and processes.

The 12 Principles of Green Chemistry Table – 5 A
1. Pollution Prevention 2. Atom Economy 3. Less Hazardous Chemical Synthesis 4. Designing Safer Chemicals 5. Safer Solvents and Auxiliaries 6. Design for Energy Efficiency

The 12 Principles of Green Chemistry **Table – 5 A**

7. Use of Renewable Feedstocks 8. Reduce Derivatives 9. Catalysis 10. Design for Degradation
11. Real-time analysis for Pollution Prevention 12. Inherently Safer Chemistry for Accident Prevention

Reference: 5. & Table - 5 A. What is Green Chemistry - <https://www.calpaclab.com/what-is-green-chemistry/>

6 .The Goal of Green Chemistry

Understanding the chemical aspects of renewable energy. Using sustainable resources.

Designing new, greener and safer chemicals and materials. Preventing pollution at the molecular level (learn more about hazardous waste). Creating innovative solutions through safe chemical practices to solve real-world problems. Maintaining and designing new chemical products and processes to reduce intrinsic hazards.

6.1 How green chemistry differs from cleaning up pollution ⁶

How green chemistry differs from cleaning up pollution **Table – 6 A**

- Green chemistry reduces pollution at its source by minimizing or eliminating the hazards of chemical feedstocks, reagents, solvents, and products.
 - This is unlike cleaning up pollution (also called remediation), which involves treating waste streams (end-of-the-pipe treatment) or clean-up of environmental spills and other releases. Remediation may include separating hazardous chemicals from other materials, then treating them so they are no longer hazardous or concentrating them for safe disposal.
 - Most remediation activities do not involve green chemistry.
- Remediation removes hazardous materials from the environment; on the other hand, green chemistry keeps the hazardous materials out of the environment in the first place.

How green chemistry differs from cleaning up pollution Table – 6 A

- If a technology reduces or eliminates the hazardous chemicals used to clean up environmental contaminants, this technology would qualify as a green chemistry technology. One example is replacing a hazardous sorbent [chemical] used to capture mercury from the air for safe disposal with an effective, but non-hazardous sorbent. Using the non-hazardous sorbent means that the hazardous sorbent is never manufactured and so the remediation technology meets the definition of green chemistry.

Reference : 6 & Table 6 A . Basics of Green Chemistry - United States Environmental Protection Agency

7. The 10 Green Chemistry Principles Applied Figure – 7 A



Reference : Figure 7 A . SUSTAINABILITY PERFORMANCE REPORT 2017 – 2018, Dystar www.DyStar.com

8. Responsible Care⁸

Responsible Care is the global chemical industry's environmental, health and safety (EHS) initiative to drive continuous improvement in performance.

It achieves this objective by meeting and going beyond legislative and regulatory compliance, and by adopting cooperative and voluntary initiatives with government and other stakeholders. Responsible Care is both an ethic and a commitment that seeks to build confidence and trust in an industry that is essential to improving living standards and the quality of life.

The Responsible Care Global Charter arose from an examination of chemical industry practices and performance that has evolved since the mid-1980s, and was shaped by considering the recommendations of independent stakeholders from around the world.

The Charter goes beyond the original elements of Responsible Care since its inception in 1985. It also focuses on new and important challenges facing the chemical industry and global society, including the growing public dialogue over sustainable development, public health issues related to the use of chemical products, the need for greater industry transparency, and the opportunity to achieve greater harmonization and consistency among the national Responsible Care programmes currently implemented.

The International Council of Chemical Associations (ICCA), through Responsible Care, will continue to undertake actions consistent with the environmental principles of the United Nations Global Compact.

8.1 THE RESPONSIBLE CARE GLOBAL CHARTER CONTAINS NINE KEY ELEMENTS

THE RESPONSIBLE CARE GLOBAL CHARTER CONTAINS NINE KEY ELEMENTS Table – 8 A

1. ADOPT GLOBAL RESPONSIBLE CARE CORE PRINCIPLES.
2. IMPLEMENT FUNDAMENTAL FEATURES OF NATIONAL RESPONSIBLE CARE PROGRAMMES.
3. COMMIT TO ADVANCING SUSTAINABLE DEVELOPMENT.
4. CONTINUOUSLY IMPROVE AND REPORT PERFORMANCE.
5. ENHANCE THE MANAGEMENT OF CHEMICAL PRODUCTS WORLDWIDE – PRODUCT STEWARDSHIP.

THE RESPONSIBLE CARE GLOBAL CHARTER CONTAINS NINE KEY ELEMENTS Table – 8 A

6. CHAMPION AND FACILITATE THE EXTENSION OF RESPONSIBLE CARE ALONG THE CHEMICAL INDUSTRY'S VALUE CHAIN.
7. ACTIVELY SUPPORT NATIONAL AND GLOBAL RESPONSIBLE CARE GOVERNANCE PROCESSES.
8. ADDRESS STAKEHOLDER EXPECTATIONS ABOUT CHEMICAL INDUSTRY ACTIVITIES AND PRODUCTS.
9. PROVIDE APPROPRIATE RESOURCES TO EFFECTIVELY IMPLEMENT RESPONSIBLE CARE.

Reference : 8 & Table - 8 B INTERNATIONAL COUNCIL OF CHEMICAL ASSOCIATIONS. Responsible Care. www.icca-chem.org
www.responsiblecare.org

9.Sustainable Chemistry⁹

Sustainable chemistry is a scientific concept that seeks to improve the efficiency with which natural resources are used to meet human needs for chemical products and services. Sustainable chemistry encompasses the design, manufacture and use of efficient, effective, safe and more environmentally benign chemical products and processes. oecd.org

9.1 CRITERIA FOR SUSTAINABLE LEATHER AUXILIARIES

CRITERIA FOR SUSTAINABLE LEATHER AUXILIARIES

- Use of renewable resources • Good absorbability
- Ready biodegradability • High proportion of bio-based raw materials
- High concentration of active matter • Safety for both the user and the environment
- Fulfilment of highest quality standards concerning modern automotive leather products
- Establishment of a responsible resource management for our own production and supply chain

Reference : 9 & Table 9 A. LEATHER AUXILIARIES -For the sustainable production of automotive leather Zschimmer & Schwarz www.ZSCHIMMER-SCHWARZ.COM

10. ESG ¹⁰

“ESG” describes a set of environmental, social and governance factors. Responsibility to participate in sustainable development is not only as a duty to society but as an opportunity to do well by doing good. ESG is a simple acronym for environmental (natural resource use efficiency and impacts), social (stakeholder engagement) and governance (oversight and management topics).

10.1 Select ESG Factors Figure – 10 A



Reference : 10. & Figure – 10 A .ENVIRONMENTAL, SOCIAL, AND GOVERNANCE (ESG) for Private Equity: The Basics.

10.2 ESG commitments ^{10 B}

1. Continuously minimize direct environmental impact and carbon footprint.2. Ensure a safe working environment and a diverse culture for our employees.3. Consolidate Stahl's ESG leadership position by engaging with influential. NGOs and IGOs on responsible chemistry, positioning ourselves as a trusted and knowledgeable partner.4. Nurture diversity and inclusion to continuously improve employee skills and company attractiveness.5. Foster ethical behavior by providing training and robust compliance programs.6. Select and engage with suppliers based on recognized ESG standards.7. Promote a sustainable development mindset, to motivate employee throughout our organization.

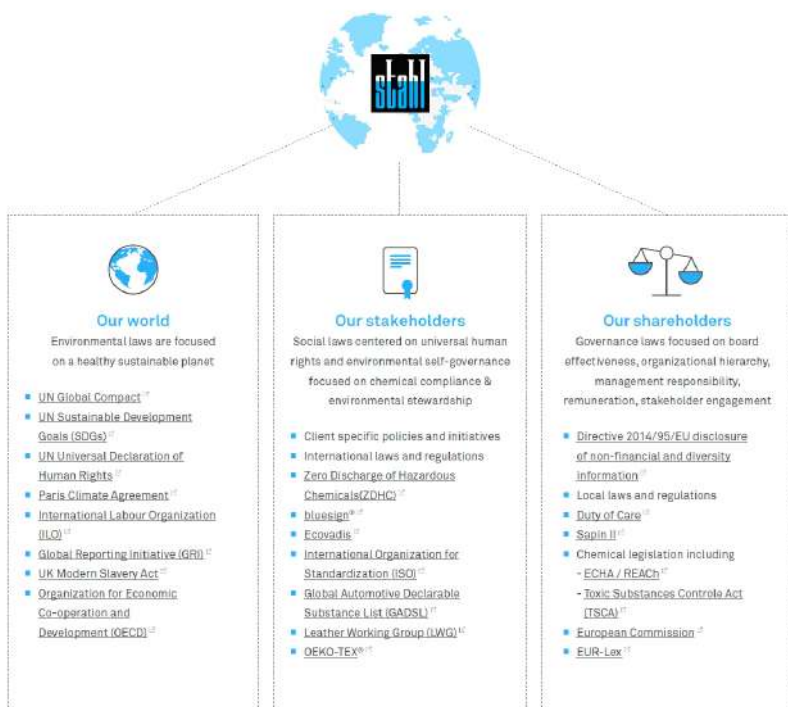
10.3 Identified four areas of strategic importance ^{10 B}

Digital transformation, Open innovation, Renewable feedstocks, Sustainable development.

11. ESG Landscape - Environment, social & governance report-2019 , Stahl Group ¹¹

The below ESG landscape provides a flavor of all the laws and regulations, (mandatory and voluntary) guidelines and initiatives that impact the company. Stahl is subject to continuous assessment of its ESG performance, e.g.: ISO certification, safe workplace monitoring, water controls, social audits, risk assessment questionnaires and chemical conformance testing of its products.

ESG landscape – Stahl Figure – 11 A





Responsible chemistry

Our commitments focus on our Environment, Social and Governance performance

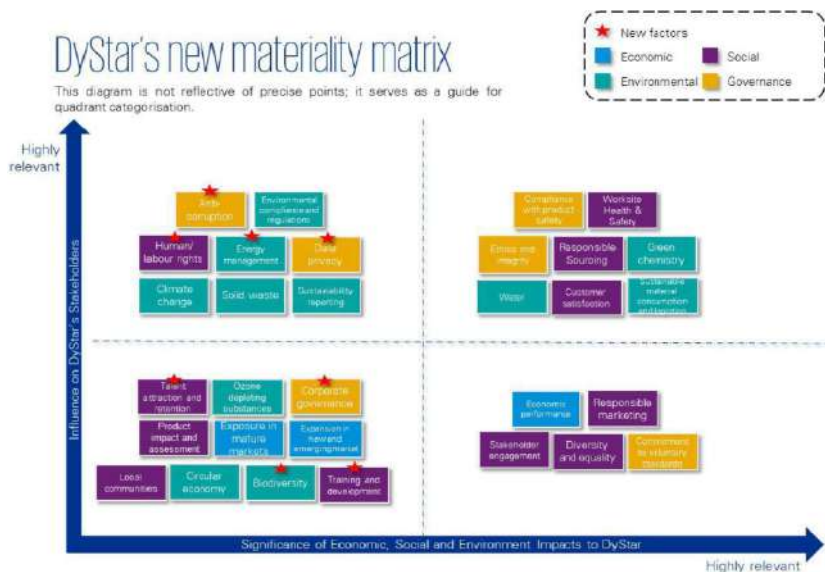
- Stahl Safety, Health and Environment Policy¹²
- Stahl Sustainability Standard¹³
- 12 Principles of Responsible Chemistry¹²
- Diversity & inclusion policy¹²
- Stahl Manufacturing Restricted Substances List (Stahl MRSL)¹²
- Code of Conduct for Business Partners¹²
- Code of Conduct for Employees¹²

Reference : 11.& Figure 11 A.- ESG Landscape - Environment, social & governance report-2019 , Stahl Group

12.Dystar's New Materiality Matrix

Dystar's New Materiality Matrix highlights the key ESG areas that are significant both for Dystar and stakeholders. It also guides sustainability approach and targets.

12.1 Dystar's New Materiality Matrix – Dystar Figure – 12 A



12.2 Economic, Social, Environment and Governance – Dystar Figure - 12 B

 Governance	 Environment	 Social	 Economic
1. Corporate governance 2. Anti-corruption 3. Ethics and integrity 4. Compliance with product safety 5. Commitment to voluntary standards 6. Data privacy	1. Climate change 2. Energy management 3. Water 4. Solid waste 5. Ozone-depleting substances 6. Circular economy 7. Biodiversity 8. Environmental compliance and regulations 9. Sustainable material consumption and logistics 10. Green chemistry 11. Sustainability reporting	1. Working health and safety 2. Diversity and equality 3. Training and development 4. Talent attraction and retention 5. Local communities 6. Human labor rights 7. Responsible marketing 8. Customer satisfaction 9. Responsible sourcing 10. Product impact assessment 11. Stakeholder engagement	1. Economic performance 2. Expansion in new and emerging markets 3. Exposure in mature markets

Reference : Figures 12 A & 12 B. Integrated Sustainability Report 2020-2021
Dystar

13. Creating Sustainable Value through Business Model

13.1 Sustainability Vision and Values – Dystar Figure 13 A

Creating Safer and Better Products	Conserving the Environment	Caring for Our People	Communicating Our Value Creation
We constantly innovate and develop higher-quality, safer, and greener products and services, which we have done so over the years to create value for our partners and consumers.	DyStar has a two-fold sustainability approach – reducing our own operational impacts and helping customers reduce their impact. In line with this dual approach, we have established an organizational sustainability structure, broad strategies and goals across the value chain and a regular sustainability reporting process with robust data collection and environmental performance monitoring. These continue to help DyStar optimize our carbon efficiency and conserve finite resources like water, waste and energy throughout our value chain.	Our people are our best asset. DyStar has policies in place to ensure a fair, diverse and inclusive working environment. In addition, we invest in training and developing our employees to reach their professional aspirations, which in turn enhance the capabilities within our organization and the wider local communities.	DyStar discloses its sustainability efforts and performance in an annual Integrated Sustainability Report. We align all our efforts and strategies to the UN Sustainable Development Goals where possible.

Reference : Figure – 13 A. Integrated Sustainability Report 2020-2021
Dystar

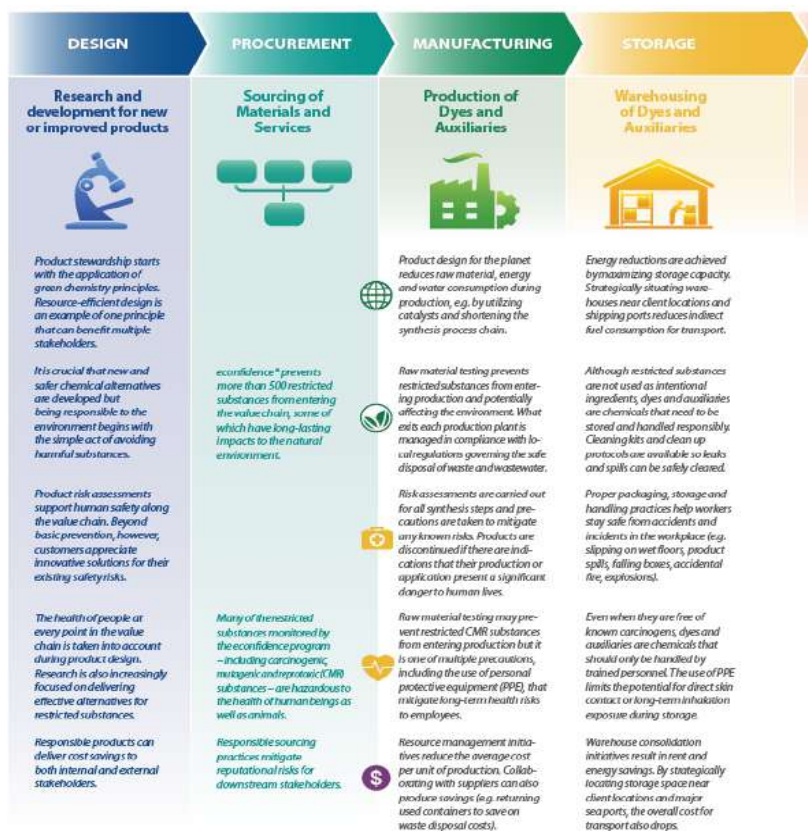
14. Product Stewardship across Value Chain- Dystar

At DyStar, product stewardship is an integrated process for identifying, managing and minimizing environmental, health and safety impacts at every stage of a product's life cycle.

It is recognized that the indirect impact of a product can be comparable, if not greater, than that resulting from our internal activities. In taking a comprehensive approach, they assess all products for health, safety and environmental consequences at each stage of the value chain – product concept development, R&D, registration, manufacturing, marketing and promotion, warehousing, distribution and supply, use and disposal, reuse and recycling.

What happens in the first stages of value chain has lasting impact long after a product has left our doorsteps. For this reason, Product Stewardship at DyStar begins at the front of the value chain - with design and sourcing.

14.1 Product Stewardship across Value Chain- DyStar Figure – 14 A



Product Stewardship across Value Chain- Dystar Figure – 14 B



Reference :14.& Figures 14 A & 14 B .2015 Sustainability Performance Report, Dystar

(to be Contd.)

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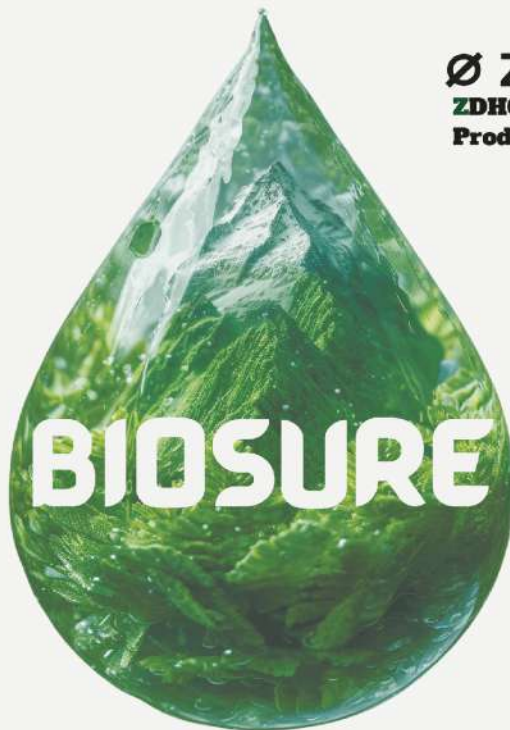
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