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# JILTA

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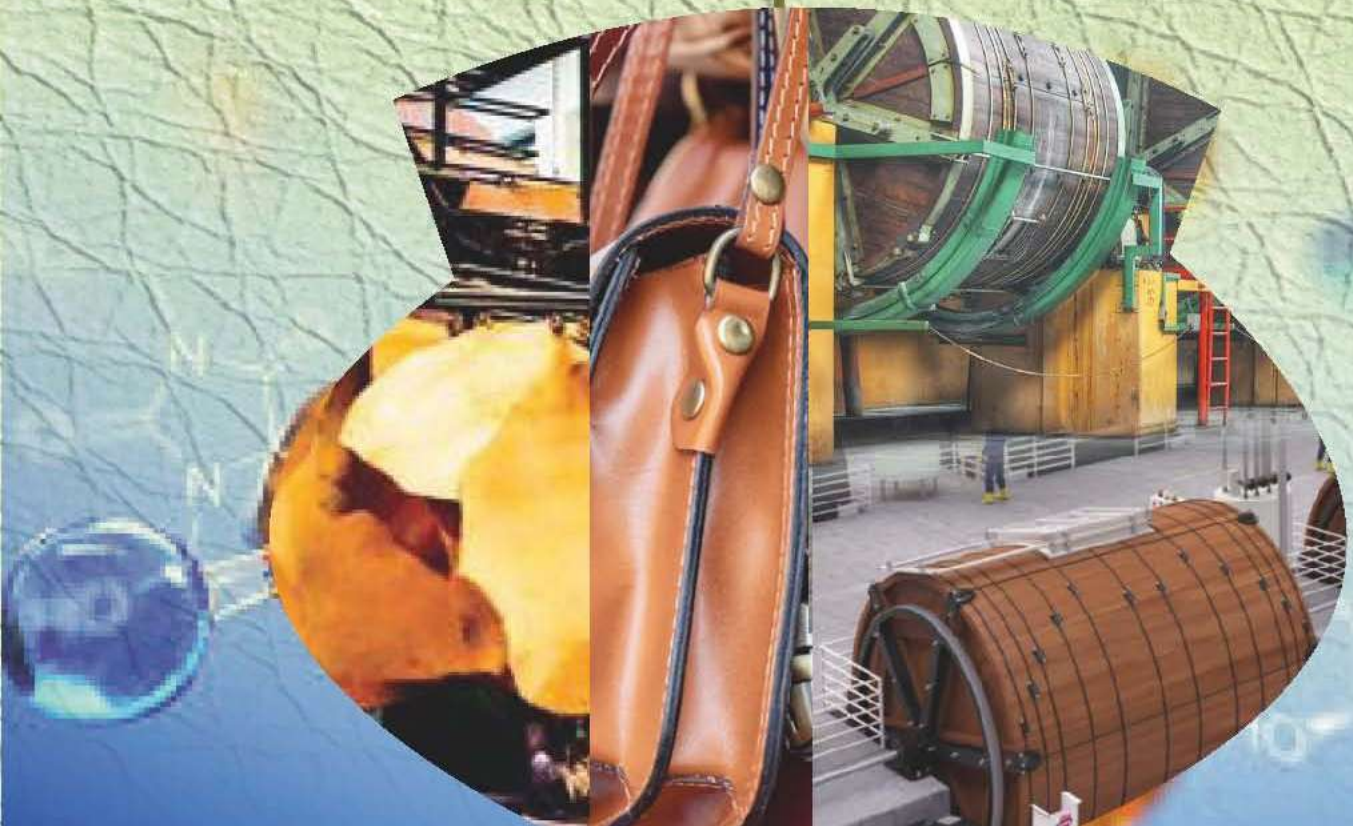

# Our Activities

- An Association with over 600 members from India and abroad working since last 68 years for the growth and development of Leather and its allied industries.
- Organize seminars, symposiums, workshops in order to share information, knowledge & latest development and interactions for the benefit of all concerned.
- Organize Human Resource Development programmes on regular basis.
- Publish for over 60 years, a technical monthly journal namely "Journal of Indian Leather Technologists' Association" (JILTA), widely circulated through out the World.
- Publish books for the benefit of the students at various levels of study, for the Research Scholar and the Industry.
- Work as interface between Industry and the Government.
- Assist Planning Commission, various Government Institutions, Ministry and autonomous bodies to formulate appropriate policies for the growth of the Industry.
- Assist small and tiny leather goods manufacturers in marketing their products by organizing LEXPOs in Kolkata and different parts of India.




## Indian Leather Technologists' Association

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

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# JOURNAL OF INDIAN LEATHER TECHNOLOGISTS' ASSOCIATION (JILTA)

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

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

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# INDIAN LEATHER TECHNOLOGISTS' ASSOCIATION (ILTA)

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

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Dr. Subhendu Chakrabarti
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# JOURNAL OF INDIAN LEATHER TECHNOLOGISTS' ASSOCIATION (JILTA)


Leather Fraternity 72 years of service to the International

UN environment

International Resource Panel

# Green Technology Choices:

## The Environmental and Resource Implications of Low-Carbon Technologies

INTERNATIONAL RESOURCE PANEL REPORT

# Israel - Arab relations : An Overview

For several years, backchannel ties between Israel and some Gulf Arab states have been developing in the shadows. While Israel is not shy about the relationship, the Gulf states have hoped to keep their rapprochement with Israel under wraps for obvious reasons pertaining to the Israeli-Palestinian conflict. Yet increasing diplomatic exposure has brought the relationship out into the open and signaled possible momentum toward the establishment of formal relations for the first time.

After Israeli Prime Minister Benjamin Netanyahu's official visit to Oman in October—the first for an Israeli head of state since 1996—he has been vocal in his intentions to build on that by solidifying ties with other states, including Bahrain. The Israeli press even reported, citing the prime minister's office, that Netanyahu intends to formalize relations with Saudi Arabia ahead of the upcoming Israeli elections, which at the time were slated for November.

While this is likely far-fetched, and cannot be separated from political posturing within Israel, in today's Middle East it is not difficult to discern the reasons why both sides would court each other. Excessive regional instability and mistrust are heightening tensions between states, especially with adversaries like Iran. The region lacks a collective security framework of any kind, and after nearly two decades of war, America's appetite for further military engagement in the region has waned, leaving open a considerable security vacuum. Salvaging America's security commitment is at the heart of the Gulf overture to Israel. It is worth considering, then, the nature of this relationship for both sides, its relative value, and the possible risks it entails, especially for the Gulf states.

Over the course of his long political career, Netanyahu has faced the persistent criticism that his policies vis-à-vis the Palestinians would lead to Israel's isolation abroad. In order to counter that claim, especially in recent years, Netanyahu has made developing relations with unfriendly states a key component of his foreign policy. Indeed, despite pushing Western Europe further from Israel, the prime minister has achieved a decent level of success in capitals across Eastern Europe, Africa, and Asia—but the Gulf Arab states still remain the holy grail of that effort. If Netanyahu can show that the wealthy countries of the region are willing to normalize relations with Israel despite continued settlement building in the West Bank and no peace on the horizon with Palestinians, then the criticism of Netanyahu holds no water, and he will have been proven right—at least in the medium term. More importantly, Netanyahu will have done it without meaningfully adopting the land-for-peace formula in regards to the Palestinians that has been the basis for Arab-Israeli negotiations since it was developed during the Camp David process in the late 1970s.

Indeed, in a recent meeting with Israeli diplomats, Netanyahu said that the country no longer needed peace with the Palestinians to forge diplomatic ties with the Arab world. "The Arabs are looking for links with the strong," Netanyahu claimed. "Cultivating strength gives us diplomatic power". Just days before, during a press conference, Netanyahu stressed that while other Israeli leaders had tried to bridge the relationship with the Arab and Muslim world through "concessions" to the Palestinians, he had adamantly refused. "We believe in peace out of strength," Netanyahu countered. "We believe in alliances born out of Israel's value as a technological, financial, defense, and intelligence powerhouse."

Netanyahu's logic follows the Jabotinskian ideological line in which Arab rejection of Israel ultimately breaks against the "iron wall" of Israeli power, from which acceptance of Israel's place among the nations of the region commences. It is also a direct rebuke to the Arab Peace Initiative that Saudi Arabia spearheaded in 2002, which called for Arab states to normalize relations with Israel in exchange for a return to the 1967 borders and a fair resolution of the Palestinian refugee problem. Today's rapprochement with Israel by the Gulf states abandons that formula, and rests on three main pillars that have nothing to do with the Palestinians, but certainly affect them.

The first pillar is Iran and the geopolitics of the Middle East after 2011. There is no question that Israel and the Saudi-United

Arab Emirates (UAE) axis see eye-to-eye when it comes to their mutual nemesis in the region, which has provided common ground to develop deeper security ties. The Gulf alliance led by Saudi Arabia and the UAE has recognized Israel—the region's most formidable military and its only nuclear power—as a forceful ally in their own struggle with the threat of Iranian expansionism. For Israel, too, instead of facing off against Iran alone, the Islamic Republic becomes a regional threat, giving Israel more legitimacy in how it responds.

The second reason is the Gulf states' growing need for sophisticated security and surveillance platforms to police their own populations in the wake of the regional uprisings. Israel's expertise in this regard, honed during its 51-year occupation of the Palestinian territories, is as sophisticated as it comes. And despite the possibility that Israel has built backdoors into all its systems, and there are other available sellers, some Gulf states have become ready consumers of Israeli technology as a corollary of their newfound ties.

Lastly, and maybe most importantly, for several decades the Gulf states have maintained close ties to Washington based on the mutual interests of maintaining security and stability in the Persian Gulf, and the free flow of oil to global markets. Yet those ties have always been limited by their fundamental transactionalism and the emphasis on building personal relationships with powerful people in Washington as a substitute for lacking broad support among the American public. Moreover, the Gulf states—and Arab states in general—have always been hindered by the distrust of Israel's ardent supporters in Washington, who are considerably influential on America's Middle East policy.

While in the past those ties may have felt sufficient, since 9/11—with the Iraq war, the Arab Spring, rising U.S. oil production, the Iran nuclear deal, and the Justice Against Sponsors of Terrorism Act—it has become clear to the Gulf states that their relationship with Washington is uncomfortably tenuous, and their confidence in the United States as a reliable partner and security guarantor has flagged. By positioning themselves as a partner of Israel, the Gulf states are likely hoping to mitigate the opposition in Washington, while reaffirming the U.S. security commitment by linking Israel's security with their own.

Standing in the way of this convergence, however, are the Palestinians and their intractable conflict with Israel. The Gulf states have always been party to the regional aspect of this conflict, and while they have never really engaged militarily, they have maintained rhetorical, diplomatic, and material support for the Palestinians and an unwavering public rejection of Israel.

Yet in the post-Oslo era, with the Palestinian Authority in a state of precarious accommodation with Israel and the PLO no longer relevant, some of the zeal surrounding the Palestinian cause has faded. Today, there is an impetus to sideline the Palestinians in pursuit of more pressing national interests. Although the Gulf states have been careful not to be too public in their dealings with Israel, they are clearly moving forward under the belief that the Palestinian cause lacks the same traction with their publics, especially the younger generations. This could prove to be a mistake.

Certainly, the Palestinian issue has been overshadowed in recent years by the severe tumult in the region. Moreover, it is difficult for the younger generation of Arabs to identify with an aging and stagnant Palestinian leadership. Yet there is no clear indication that this is a permanent trend. Indeed, given the longstanding durability of the issue, which has remained a top regional priority for more than 70 years, it is more plausible to reason that the phenomenon is contextual and can be reversed if circumstances change. Arab identification with the Palestinians and antagonism with Israel are deeply woven into the cultural and political fabric of society. The Arab states cannot simply abandon this decades-old position without undermining their credibility. Moreover, doing so empowers their regional rivals, Iran and Hezbollah—the very forces they are trying to counter by allying with Israel—as well as domestic opponents, especially radical Sunni Islamists, and even many liberals and pan-Arabists. While the regional turmoil is likely to remain for the foreseeable future, the stagnation of the Palestinian situation is not. If circumstances change, say in the event of another intifada, and Arab public support for the Palestinians is reinvigorated, the Arab states with ties to Israel risk being caught on the wrong side of a red line they thought had softened and blurred. Consolidating support at home is not just the prerogative of Netanyahu; in the wake of the Arab uprisings of 2011, it is the primary focus of the Gulf states, as well.

That is not to say that a greater degree of regional integration for Israel could not have beneficial side effects, including for the Palestinians. But the possibilities are limitless and hard to predict. What are more certain are the short- to medium-term consequences, which do not augur well for the Arabs. Netanyahu gains something for nothing while reinforcing the notion that he does not need to settle the conflict with the Palestinians to have better relations with the Arab world. The Palestinians lose

a key source of leverage vis-à-vis Israel and could find themselves more isolated than ever before. And the Gulf Arab states gain a risky alliance with Israel, without necessarily clinching too much in return that they do not have already by default.

Even closer ties with the United States—the most crucial pillar in this relationship—are far from being a certain outcome. Indeed, in mid-December, on the eve of a U.S. Senate vote to censure Saudi Arabia for the war in Yemen and the killing of Saudi columnist and critic Jamal Khashoggi in Istanbul, Netanyahu offered unprecedented words of support for the Gulf kingdom in the Israeli press, saying Riyadh is critical to global stability, and asserting "the importance of Saudi Arabia and the role it plays in the Middle East." It had no discernible effect.

Moreover, when it comes to linking their security with Israel's, the Gulf states should be careful what they wish for. Israel has pushed for years to come under the purview of U.S. Central Command, which oversees U.S. military operations in the Middle East. If such a thing comes to pass, the Arab states risk having their defense needs subsumed by Israel's unique security lens, something they are sure to regret.

On 15 September 2020, top officials from Bahrain, Israel, the UAE and the U.S. met in the White House to sign the Abraham Accords. This marked the establishment of full diplomatic ties between Israel and the two Arab nations; until then, only two Arab states—Egypt and Jordan—had formally recognized Israel. The Abraham Accords were swiftly followed by a similar deal with Morocco. Ties with regional juggernaut Saudi Arabia—while still informal—have also warmed, with Israeli businessmen recently addressing an important Saudi investment conference.

The economic implications of this rapprochement are important, as the synergies between Israel and the Arab states are clear. Israel offers the region's most advanced technology, with particular strengths in defense, cybersecurity, healthcare and agriculture—accessing this tech would help diversify the economies of the oil-dependent Gulf states. On the flipside, Israel stands to benefit from greater capital investment, access to new export markets and more tourist arrivals.

Early signs are encouraging. Israel and the UAE clinched a free trade agreement (FTA) in May, which aims to raise bilateral trade to USD 10 billion annually—up from less than USD 200 million in 2020. The UAE-Israel Business Council predicts there will be nearly 1,000 Israeli companies working in the UAE by the end of this year. Moreover, Israeli exports to Morocco roughly tripled in annual terms in 2021, while those to Bahrain rose many times over. An FTA with Bahrain could be concluded by end-2022."

These improving relations are likely partly behind our analysts' rosy GDP growth projections for Israel for the coming years, which are far above the average for major advanced economies. However, diplomatic progress is fragile and could be set back by a renewed outbreak of Israeli-Palestinian violence. The likely presence of the ultra-conservative Religious Zionist movement in the next Israeli government is also a risk, as it could increase tensions with Arabs at home and abroad—one of the movement's key figures has proposed deporting Arab citizens who show 'disloyalty' to the Israeli state, for instance. Moreover, Israel has an image problem among Arabs abroad; opinion polls suggest most are against normalization, and tourist arrivals to Israel from Bahrain, Morocco and the UAE reportedly remain minimal. There is thus still much to be done to maximize the economic potential of Israel's regional integration.

Regarding an Israel-Bahrain FTA, **analysts at the EIU said**: The Gulf state's small economy, which is undergoing a renewed diversification and development drive, has far more to gain from the increase in direct trade that an FTA could herald: there have been signs recently of collaboration in fintech (a Bahraini strength and priority), with a cooperation agreement signed in August between Israel Advanced Technology Industries and Bahrain's "Fintech Bay", a government backed industry hub and incubator. The primary interest for Israeli companies is ease of procedural and physical access to Saudi Arabia (which is already quietly extending political and economic cooperation with Israel but unlikely to normalize ties under the current king)."

Goutam Mukherjee

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


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

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

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

If it can be imagined, it can be created.


Stahl
We imagine sustainable pickle-free leather tanning
If it can be imagined, it can be created.
Tanners benefit from higher process efficiency, reduced water, chemical and salt consumption and a reduced environmental impact. This makes it possible for tanners to have an efficient process that is also sustainable and yields eco-friendly premium leathers.
High-quality leather no longer forces a choice between responsible processes and efficiency. The main benefits of a pickle-free system that avoids salt addition during pickling are:
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▪ Shorter process time on cow, sheep and goat
▪ Cleaner effluent, TDS reduction by up to 40%

# STAHL TO EXPAND LOW-IMPACT AUTOMOTIVE CUSTOMER OFFERING WITH DEDICATED RANGE OF RELCABOND® ADHESIVE AND BONDING SOLUTIONS


Stahl, an active proponent of responsible chemistry, is to offer a dedicated portfolio of low-impact, high-performance adhesive and bonding solutions. As an initial step, Stahl will introduce three dedicated adhesive products, under the RelcaBond® brand name, designed primarily for customers operating in the automotive sector, as well as other markets.fl

Stahl's expansion into the adhesive and bonding segment builds on the company's longstanding presence in the elastomer coatings market. With the RelcaSil® product range, Stahl has developed a reputationfor offering durable, reliable, high-performance coatings. The company is also leading on environmental stewardship by developing solutions that have a lower environmental impact than traditional market alternatives.

Stahl's adhesive and bonding product offering draws on the company's long-standing research and innovation focus in the automotive space. This is channeled through Stahl's dedicated Centers of Excellence for Automotive, from supporting product development to advanced technologies and testing equipment. Equally, Stahl is able to offer extensive technical and research and development support to automotive customers, including original equipment manufacturers (OEMs) and Tier 1 suppliers.

Mel Micham, Global Market Director, Stahl Performance Coatings: "At Stahl, our aim is always to remain close to our customers and give them the tools and support they need to keep pace with fast-changing market requirements. This includes improving both the performance and the environmental credentials of products and applications. By building on our strong foothold in adjacent markets, we are proud to offer a unique range of low-impact, high-performance adhesive products that are truly best in class."

Stahl's expansion into the adhesive and bonding market will begin with the following products:

**RelcaBond® 815**

RelcaBond® 815 is a low-VOC flock adhesive that provides excellent adhesion to vulcanized rubber and is ideally suited to automotive customers. This adhesive is non-staining, as well as being BTX- and HAP-free. It also offers superior flock density, durability, adhesion, and chemical resistance.

The product is designed for the adhesion of polyester or nylon flock fibers to a variety of elastomer substrates. It protects the rubber sealing from wear, facilitates glass sliding, and contributes to noise reduction and increased passenger comfort.

**RelcaBond®650**

RelcaBond® 650flis a glass encapsulation adhesive that offers a more sustainable, water-based alternative to traditional solvent-based solutions. RelcaBond®fl650 provides a glass-to-polymer bond for automotive modular windows, including encapsulated side and rear windows and windshields. It works by forming a strong bond between the polymer and the window glass during the encapsulation process. Stahl is initially launching RelcaBond® 650 in selected markets, with roll-out on a global scale.

**Rubber-to-metal adhesives**

Stahl currently has a portfolio of rubber-to-metal adhesives in the development phase. These innovative solutions work on elastomers that need to be bonded to metal, and their applications extend far beyond the automotive industry. In

particular, Stahl is focused on exploring the development of more sustainable, water-based alternatives to the traditional solvent-based products that currently dominate the rubber-to-metal adhesives segment.

Uwe Siebgens, Group Director, Performance Coatings & Polymers: *"With the new RelcaBond® series*, Stahl is extending its portfolio of responsible chemicals into the field of adhesives and bonding agents. This represents a natural next step in our successful journey to offer sustainable, high-performing solutions for the coatings industry."

*(Stahl News – 12/10/2022)*

## STAHL AND UNIVAR SOLUTIONS STRENGTHEN PARTNERSHIP BY EXPANDING DISTRIBUTION AGREEMENT TO CUSTOMERS IN BRAZIL AND COLOMBIA

**S**tahl, an active proponent of responsible chemistry, has confirmed a new distribution agreement withflUnivar Solutions, a leading global solutions provider to users of specialty ingredients and chemicals for coatings, adhesives, sealants, and elastomers. Univar Solutions Brazil and Univar Solutions Colombia will deliver Stahl products to customers in Brazil and Colombia, respectively. The agreement was made effective September 1, 2022. With more than 90 years of experience in chemical and ingredient distribution, Univar Solutions' expertise will help Stahl anticipate and leverage meaningful growth opportunities in two of South America's most dynamic economies. The new agreement builds on Stahl's long-standing partnership with Univar Solutions, who has served as Stahl's distributor in Eastern Europe for several years. The companies share a commitment to sustainability, social responsibility, and supply chain efficiency, making the collaboration highly beneficial for both parties.

*Stahl is delighted to announce this expanded partnership with Univar Solutions,"* said Raymond Bakker, Global Business Director Stahl Polymers. *With" our values and priorities so closely aligned, Univar Solutions was the natural choice to help Stahl expand in South America. By working more closely together, we will deliver greater value for customers, investors, and wider society .*

Under the new agreement, Univar Solutions will distribute Stahl's extensive range of products and polymers for coatings material customers. The products are mainly acrylic resins, polyurethanes, and the special polymers from Stahl's European and Brazilian production and are used in various industrial and wood coating applications. The registered trade namesflPicassian®flandflRelca®flare already established in the market and are well known in the coatings industry.

"I'm very pleased to expand our relationship with Stahl into Brazil and Colombia, thus bringing more product solutions to our industrial coatings customers. Growing relationships such as this showcase the true global nature of the Univar Solutions' CASE business and how we bring value to customers and supply partners,"said Chris Fitzgerald, global vice president, CASE, Rubber and Plastic Additives for Univar Solutions.

*(Stahl News – 09/09/2022)*

# *From the desk of* General Secretary

## 64TH ANNUAL GENERAL MEETING OF ILTA

As intimated to all eligible Members vide 64th AGM Notice posted as Registered Book Post on 13th September' 2022, this was held on 14th October, 2022 at 03.00 PM IST (Registration started from 02.30 pm IST) at the Seminar Hall of Science City, Kolkata. as per the following Agenda including formal announcement of the results of the Election of Executive Committee of ILTA for the session 2022 - 2024.


**A.** Confirmation of the Proceedings of 63rd Annual General Meeting held on 30th September, 2021.

Being no question raised this was passed unanimously. Proposed by Mr. Ratan Choudhury and seconded by Mr. Asit Baran Kanungo.

**B.** To consider and adopt the audited Balance Sheet and Statement of Accounts for the Financial Year ending 31st March 2022.

Mr. Susanta Mallick, General Secretary explained the above and being no question raised this was passed unanimously. Proposed by Mr. Tarak Saha and seconded by Mr. Bibhas Chandra Jana.

**C.** To consider and adopt the Annual Report of the General Secretary on behalf of the Executive Committee.

This also explained by Mr. Susanta Mallick, General Secretary and being no question raised this was passed unanimously. Proposed by Mr. Ratan Choudhury and seconded by Mr. Asit Baran Kanungo.

**D.** Formal announcement of the result of the election for reconstitution of ILTA Executive Committee for the term 2022 - 24.

Mr. Dhiman Chakraborty, Chief Finance Controller, Asiatic Society, Kolkata who acted as the Returning Officer for the election read out his report and declared the following elected members for the post shown against them for the term 2022-2024 in order of highest votes secured.

Exc. Comm Members (7 Nos.) :

1. Mr. Alokesh Roy
2. Mr. Abhijit Das

3. Mr. Mihir Prasad Das
4. Mr. Udayaditya Pal
5. Mr. Jiban Dasgupta
6. Mr. Amit Kumar Mondal
7. Mr. Aniruddha De

In addition to above the following were declared elected unopposed to the post shown against them.

| | | | |
|---|---|---|---|
| 1. | President | : | Mr. Arnab Jha |
| 2. | Vice-President (C.R.) | : | Mr. Asit Baran Kanungo |
| 3. | Vice-President (N.R.) | : | Mr. Pulok Majumdar |
| 4. | Vice President (S.R.) | : | Dr. S. Rajamani |
| 5. | General Secretary | : | Mr. Susanta Mallick |
| 6. | Joint Secretaries | : | Mr. Pradipta Konar |
| | | | Mr. Bibhas Chandra Jana |
| 7. | Treasurer | : | Mr. Kaushik Bhuiyan |

So far as the election to ILTA, Northern/Western Regional Committee for 2019-2021 is concerned, the following were declared elected unopposed, there being no other nominations :-

| | | | |
|---|---|---|---|
| 1. | President | : | Mr. Jai Prakash Saraswat |
| 2. | Vice-President | : | Mr. Rajeev Mehta |
| 3. | Secretary | : | Mr. Sudagar Lal |
| 3. | Treasurer | : | Mr. Jaswinder Singh Saini |
| 4. | Executive Members | : | (1) Mr. Kamal Sharma |
| | | | (2) Mr. Mohinder Lal |
| | | | (3) Mr. Rajveer Verma |
| | | | (4) Mr. Jagdish Gupta |
| | | | (5) Mr. Sakattar Lal |

As far as election to ILTA, Southern Region is concerned, the following were declared elected unopposed, there being no other nominations.

| | | | |
|---|---|---|---|
| 1. | President | : | Mr. N. R. Jaganathan |
| 2. | Vice-President | : | Dr. J. Raghava Rao |
| 3. | Secretary | : | Dr. R. Mohan |
| 4. | Treasurer | : | Dr. Swarna V. Kanth |
| 5. | Committee Members | : | (1) Dr. N. Nishad Fathima |
| | | | (2) Dr. P. Thanikaivelan |
| | | | (3) Dr. Subhendu Chakrabarti |
| | | | (4) Dr. S. V. Srinivasan |
| | | | (5) Dr. J. Kanagaraj |

**E.** To appoint the Auditor in place of M/s Ray & Ray who are retiring but are eligible for reappointment.

This was confirmed with a note that the decision would be taken time to time by the Executive Committee in due course.

With the Vote of thanks to the Chair the meeting winded up.



## LEXPO – XXXXI AT KOLKATA

The Kolkata LEXPO – XXXXI at Kolkata Ice Skating Rink from 23rd December to 1st January' 2022 are in progress. Booking of Stalls have been started. Publicity of the event is likely to be started by the last week of November' 2022.

However, status of progress regarding the proposed fair will be shared in due course.

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

## YOUTUBE CHANNEL & FACEBOOK PAGE OF ILTA

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

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

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

## RECEIVING PRINTED COPY OF JILTA EVERY MONTH

We have started to post Printed copy of JILTA from April' 2022 to members and all concerned as it was before Covid period. Simultaneously we have been sending the e-copy of JILTA through email also to all the concerned receivers.

If you are not receiving JILTA by Post or through email, may please verify your Postal Address and/or Email Id with our office at the earliest.

## PUBLISH YOUR TECHNICAL ARTICLE

Faculties, Research Scholars and students of various Leather Institutes may wish to publish their Research / Project papers in an Article form in this monthly technical journal, JILTA.

Interested author may sent their paper (in MS Word format) along with a PP Photograph and Contact details like Email, Mobile etc. to our email IDs : admin@iltaonleather.org / jiltaeditor@gmail.com

**Members are requested to :-**

a) Kindly inform us your '**E-Mail ID**', '**Mobile No**', '**Land Line No**', through E-Mail ID: admin@iltaonleather.org or over Telephone Nos. : 24413429 / 3459. This will help us to communicate you directly without help of any outsiders like Postal Department / Courier etc.

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


**General Secretary and the Members of the Executive Committee are available to interact with members at 18.30 hrs, at our Registered Office on every Thursday**

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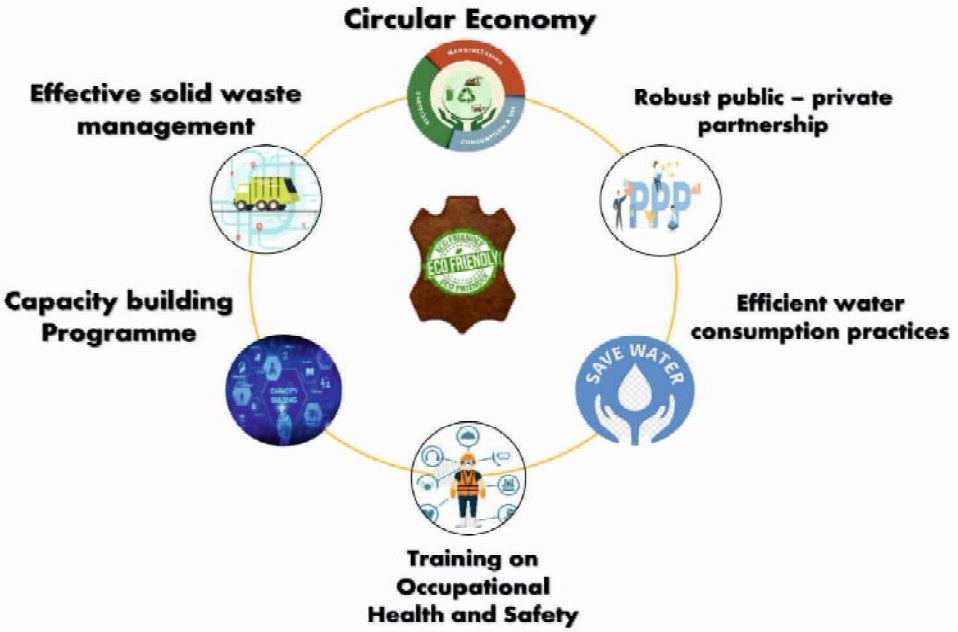
# EFFECTIVE WASTE MANAGEMENT AND SUSTAINABLE DEVELOPMENT OF MSME TANNING COMPANIES IN KOLKATA LEATHER CLUSTER (BANTALA)

## 2022-2023

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# PROTEINS OF THE SPIDER WEBS

**Dr. Buddhadeb Chattopadhyay**

Former Principal, Govt. College of Engineering & Leather Technology, Kolkata
& Former Principal, MCKV Institute of Engineering, Liluah, Howrah


Spider Web synthesized and spun effectively showing a grand design and the amazing Biochemistry behind it. You can easily identify the thick white alfa-helices. These are a supra structure of the helical bundles. The thin thread of the net is as strong as a steel of same dia. Even a butterfly with all its might cannot apply force greater than its tensile strength.

Biomaterials, having evolved over millions of years, often exceed man-made materials in their properties. Spider silk is one outstanding fibrous biomaterial which consists almost entirely of large proteins. Silk fibers have tensile strengths comparable to steel and some silks are nearly as elastic as rubber on a weight-to-weight basis. In combining these two properties, silks reveal a toughness that is two to three times that of synthetic fibers like Nylon or Kevlar. Spider silk is also antimicrobial, hypoallergenic and completely biodegradable.

This article focuses on the structure-function relationship of the characterized highly repetitive spider silk spidroins and their conformational conversion from solution into fibers. Such knowledge is of crucial importance to understanding the intrinsic properties of spider silk and to get insight into the sophisticated assembly processes of silk proteins. This review further outlines recent progress in recombinant production of spider silk proteins and their assembly into distinct polymer materials as a basis for novel products.

## PREFACE

Spider silk has attracted human interest for thousands of years, mostly due to its toughness and ductility, but also because spider silk seems not to cause inflammation and allergic

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reactions. Therefore, spider silk has been employed for hunting and fishing as well as for bandages.

In nature, spiders use their silk for several applications such as for webs, wrapping of prey, protection of their offspring and as a lifeline which ensures their safe escape from predators (Fig.1A). The variety of uses for silk among spiders is much larger than among insects like silkworms, which use their silk often for making cocoons.

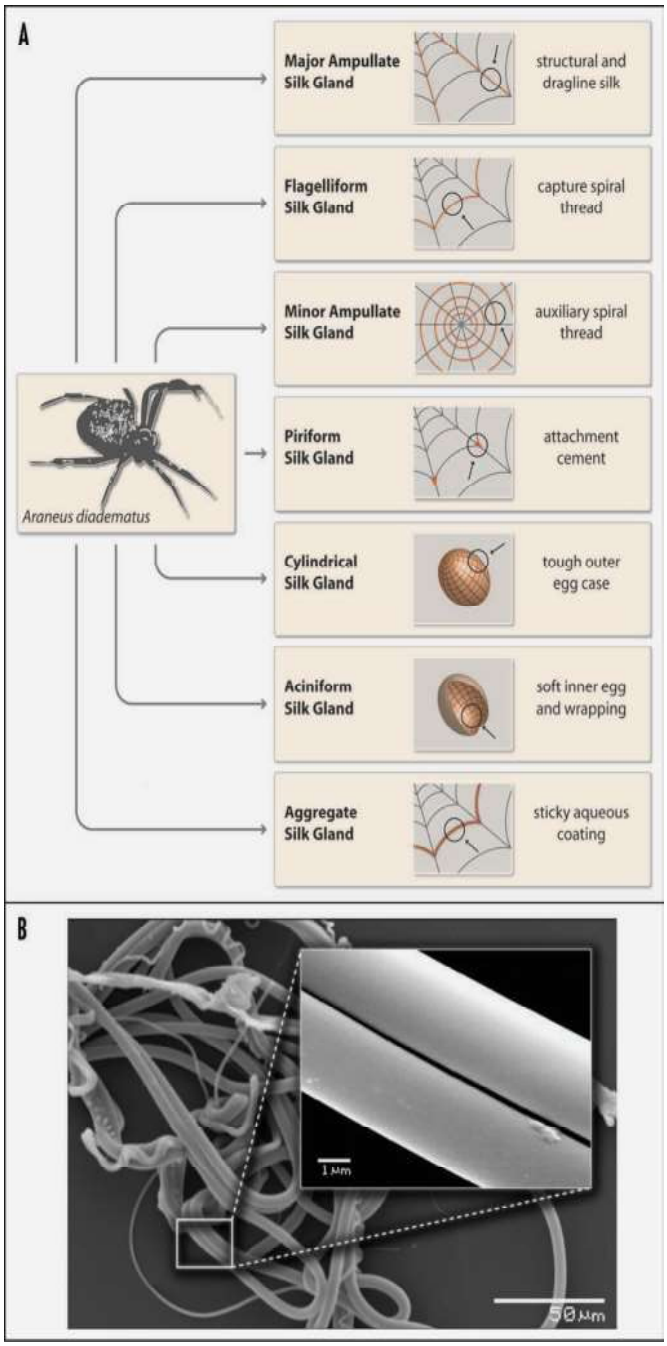


**Figure 1**

(A) Schematic overview of different types of spider silk as produced by female orb weaving spiders such as the European garden spider Araneus diadematus. (B) Electronmicrographs of natural spider silk taken from an orb web of Araneus diadematus. The various morphologies of the distinct silk types can be easily depicted. The inset shows the smooth surface of MA silk.

## CATCHING PREY IN MID-FLIGHT

Currently, more than 34,000 different spider species are known and roughly 50% thereof use webs to catch prey. Further, more than 130 different shapes of spider webs are known. Among the most studied webs are the so-called orb webs which consist of several different types of silk as shown for the European garden spider Araneus diadematus (Fig. 1A and B).

Frame and radii of orb webs are made of strong and rather rigid silk. The underlying proteins (typically two different types) are produced in the major ampullate glands and therefore silk fibers made of these proteins are named MA silk. This particular silk is further used by spiders as a lifeline (or roping thread) which has to be ready at hand to escape predators—it is therefore always dragged, hence the nickname "dragline silk." The capture spiral of an orb web comprises fibers of only one type of protein which is produced in the flagelliform (Flag) gland of spiders. Flag silk is highly elastic (up to 300%) and perfectly dissipates the impact energy of prey. For example, a typical honey bee with a body weight of 120 mg and a maximum flight velocity of about 3.1 m/s crashes into a spider's web with a kinetic energy of approx. 0.55 mJ. Flag silk with diameters of only 1–5 µm can sufficiently withstand that (on this scale) massive impact. The enormous resilience of these threads is crucial for catching and holding prey which is sometimes even bigger than the spider itself.

In addition to MA and Flag silk, orb weaving spiders utilize two further silks for constructing webs. Silk fibers made of proteins produced in the minor ampullate gland are used to build an auxiliary spiral. This temporary spiral stabilizes the body of the web and provides a template for the capture spiral.[6] Connections between Flag and MA silk (the web scaffolding connection joints) and attachment of the web frame to the substratum (trees, undergrowth, masonry…) are made of a sophisticated silk cement consisting of proteins produced in the piriform gland.

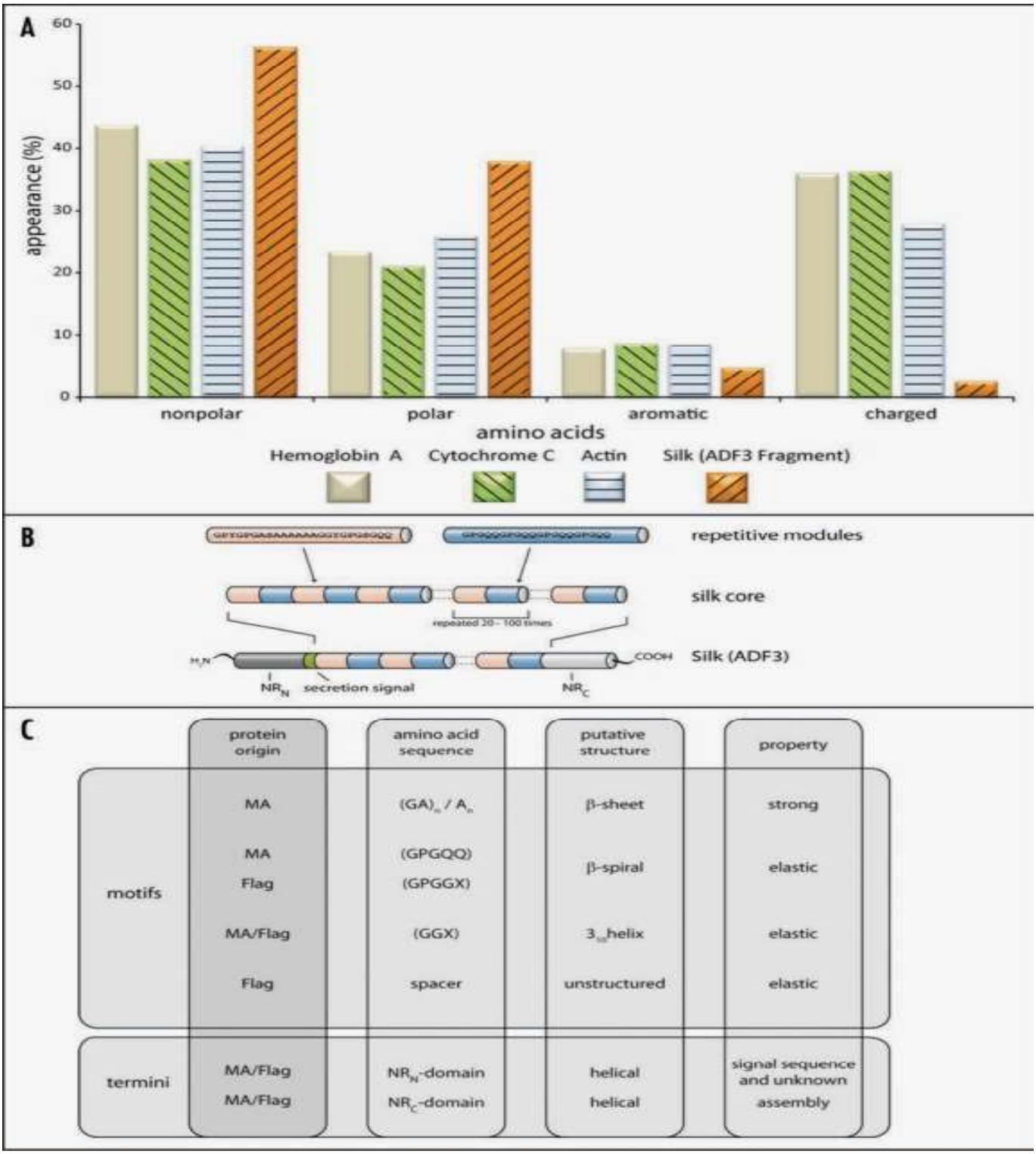


**Figure 2**

Importantly, Flag silk is not sticky. To retain prey in the web, additional glue is applied around the capture threads.[8] Evolutionarily, the first adhesive was a special silk fiber which was hackled by comb-like devices, cribella, on the spider's hind legs in order to achieve a maximum surface area. The adhesive properties of cribellate silk are mainly based on a large sum of van-der-Waals forces provided by huge surface areas similar to the adhesion principle of gecko feet, where an

extremely large surface area is provided by nano hairs on the toes.[9,10] Although an excellent adhesive, hackling of silk consumes a huge amount of time and energy. Thus, another type of spiders, ecribellate spiders, developed a different strategy of gluing. Specific silk threads are covered with a sticky aqueous layer containing organic molecules, salts, fatty acids and small glycoproteins which are produced in the aggregate gland of spiders.[11,12] Recently, it was proposed that the wet glue also contains small peptides which are thought to function as metal chelators.[8] The presence of metal ions might contribute to the inhibition of microbial growth on silk threads which is crucial to protecting the web or preventing damage to developing eggs. Wet glue is more energy- and time-efficient (compared to the cribellate system) and is therefore used by the majority of today's spiders.

## THE STRUCTURE OF SPIDER SILK

### PRIMARY STRUCTURE

Spider silk primarily consists of proteins that possess large quantities of nonpolar and hydrophobic amino acids like glycine or alanine, but for example, no or only very little tryptophan. In comparison to common cellular enzymes, it is evident that silk proteins exhibit a quite aberrant amino acid composition (Fig. 2A). Furthermore, spider silk proteins contain highly repetitive amino acid sequences, especially in their large core domain (Fig. 2B).

(A) Amino acid composition of three common proteins in comparison to spider silk. (B) Model of the hierarchical structure of a MA silk protein. For example, Araneus diadematus Fibroin-3 (ADF3) has a highly repetitive core domain flanked by two nonrepetitive domains (aminoterminal domain: NRN; carboxyterminal domain: $NR_c$). The aminoterminal domain also comprises a secretion signal sequence to allow protein export. (C) Amino acid motifs of silk proteins. The different amino acid motifs present in MA and Flag silk are correlated with their putative structure and their impact on the final properties of the thread. Although the function of the nonrepetitive parts is not fully understood, it is thought that these parts play a role in triggering the assembly of spider silks.

The repetitive sequences often account for more than 90% of the whole spider silk protein and are composed of short polypeptide stretches of about 10–50 amino acids. These motifs can be repeated more than a hundred times within one individual protein. Each polypeptide repeat therefore has distinct functional features resulting in the outstanding mechanical properties of spider silk threads.[15] MA and Flag silks contain up to four typical oligopeptide motifs which are repeated several times: [I] $(GA)_n/(A)_n$, [II] GPGGX/GPGQQ, [III] GGX (X = A, S or Y) and [IV] "spacer" sequences which contain charged amino acids (Fig. 2C). Structural analysis revealed that oligopeptides with the sequence $(GA)_n/(A)_n$ tend to form á-helices in solution and â-sheet structures in assembled fibers. The structures acquired by oligopeptides with the sequences GPGGX/GPGQQ and GGX have not yet been identified. Several studies describe these regions to adopt amorphous rubber-like structures, whereas others suggest formation of a $3_1$-helical structure.[18] Flagelliform silk, typically rich in GPGGX and GGX motifs, preferably folds into â-turn structures resulting in a right-handed â-spiral helix upon stacking (13, 14, 30).

Apart from the repetitive core domain, nonrepetitive regions are located at the protein's termini. These nonrepetitive terminal domains of the proteins are crucial for the assembly of spider silk proteins into fibers. The regions comprise approx. 100–200 amino acids and show—in contrast to the repetitive core—well defined secondary and tertiary structures in solution. Due to conserved cysteine residues, these domains can establish intermolecular disulfide bonds and are thus able to stabilize dimers and multimers under oxidizing conditions. Therefore, these domains are thought to initiate and specify assembly of silk proteins. Several carboxy-terminal nonrepetitive sequences of different silks and spiders have been identified, revealing a high sequence homology amongst these domains.

However, only one full length sequence of a Flag silk protein from Nephila clavipes covering both termini has been identified so far. Further, only recently the first full length sequence of MA silk from the black widow spider has been reported.

In contrast to the Flag silk gene, both analysed MA silk genes lack introns consisting instead of unusually large exons (>9,000 bp of coding sequence). The large exons might be a result of gene duplication processes during evolution. Additionally, genes with shorter introns generally show a higher expression rate than genes with large introns—and spider silks are highly expressed throughout the lifetime of the spider.

The primary structure of spider silk proteins shows a specific hydrophobicity pattern with alternating hydrophilic and

hydrophobic blocks in their core domains. Such amphiphilic composition is reminiscent of surfactants or biological membranes and, in the case of spider silks, is thought to be crucial for phase separation during the spinning process (see below). Additionally, the unusual amphiphilic pattern might be responsible for formation of micelles postulated as intermediate structures during thread assembly (see below).

**QUATERNARY STRUCTURE AND PROTEIN STABILITY**

After secretion from the silk glands, silk proteins are in aqueous solution and lack considerable secondary or tertiary structure.[37] Particularly in their repetitive core domains, however, the long repetitive sequences permit weak but numerous intra- and intermolecular interactions between neighbouring domains and proteins upon passage through the spinning duct. These interactions result in the formation of secondary, tertiary and quaternary structure. Roentgen diffraction analysis of the final structure of MA silk threads led to the identification of areas of high electron density embedded in areas with low electron density (Fig. 3). In a postulated model of this structure, the high electron density regions comprise crystalline sub-structures with high â-sheet content. These sub-structures are thought to be responsible for the mechanical strength of the silk thread. The elasticity of silk is based on the areas with low electron density, which are characterized by amorphous structures with few defined elements of secondary or super secondary structure.[40],[41] Such arrangement closely resembles that of protein hydrogels.[42] Upon tensile loading, the hydrogel-like areas can partially deform, contributing to the elasticity and flexibility of the thread.

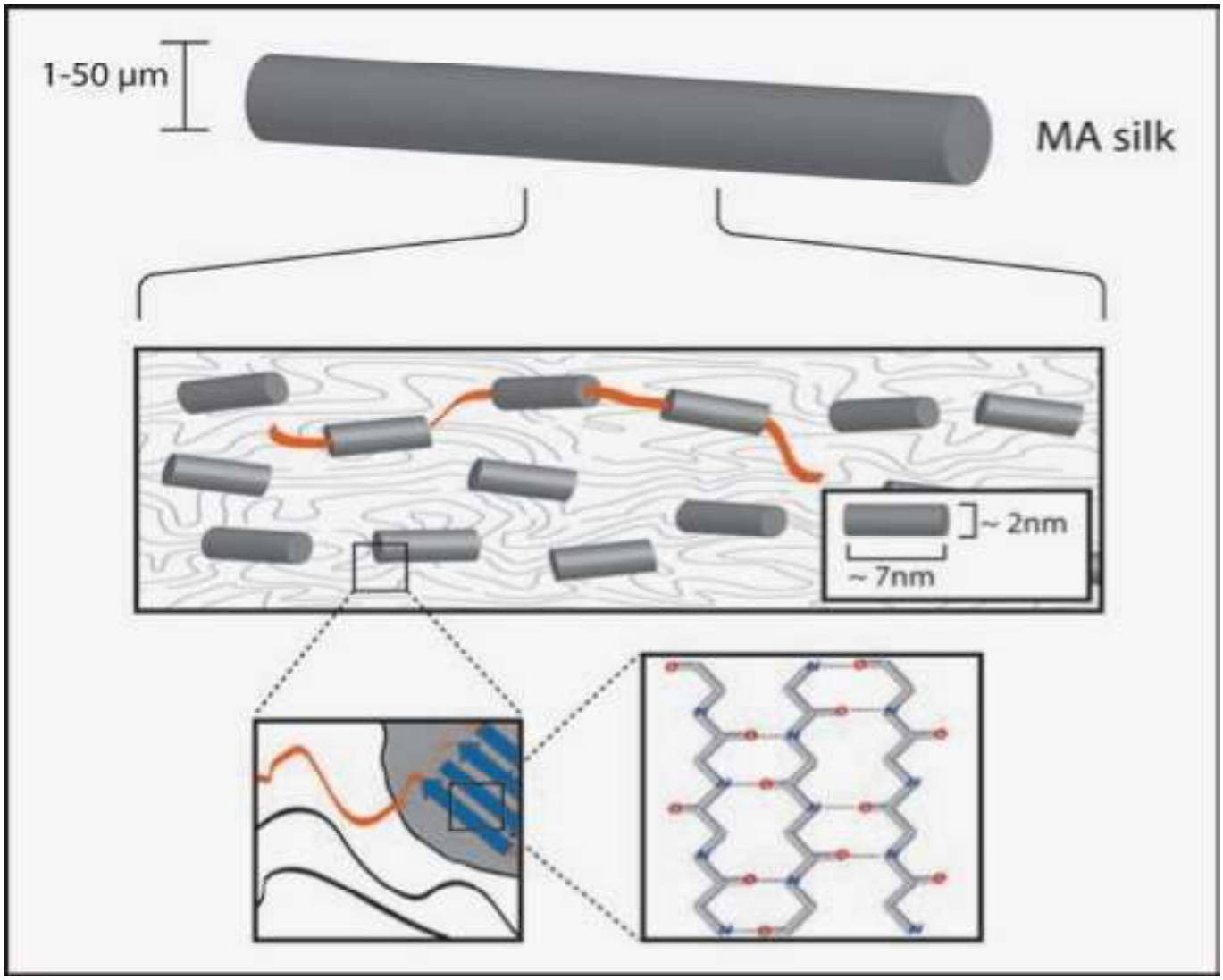


**Figure 3**

Schematic structure of spider MA silk. The thread is composed of small crystalline b-sheet rich subunits (see close-ups) which are embedded into an amorphous structure. The crystalline and noncrystalline parts are covalently connected, ensuring the coexistence of strength and ductility. Diameters of MA threads depend on species, but also on age, weight and state of health of a specific individual.

Different types of silk reveal different structural distributions (e.g., different compositions of crystalline-and hydrogel-parts). MA silk which is used for constructing the frame of the web contains a high amount of crystalline (â-sheet) structures. In contrast, the much more flexible Flag silk consists almost exclusively of amorphous hydrogel-like regions. Thus, the correlation between the structure and function of individual spider silk proteins becomes evident. However, in the future more detailed analysis is necessary to characterize the structure-function relationship of individual spider silk proteins.

## THE ASSEMBLY OF SPIDER SILK

### STARTING WITH A HIGHLY CONCENTRATED SPINNING DOPE…

As described above, assembly does not commence with globular folded protein monomers, but with mainly intrinsically unfolded proteins at extremely high concentrations. Several mechanisms are thought to be necessary to gain and maintain the high silk protein concentrations (up to 50% w/v) in the gland, including lyotropic liquid crystallinity, glycosylation of the outer surface of the folded silk proteins and phase separation induced by a polyol or by a phospholipid surfactant. Starting with an almost entire random coil structure in the gland, silk proteins rapidly assemble upon passage through the spinning duct and the silk structure becomes water-insoluble (Fig. 4). The tightly controlled assembly behaviour requires bi-stable folding of the involved protein and precise control of the environmental conditions in the spinning duct (e.g., pH, ionic concentration, water content).

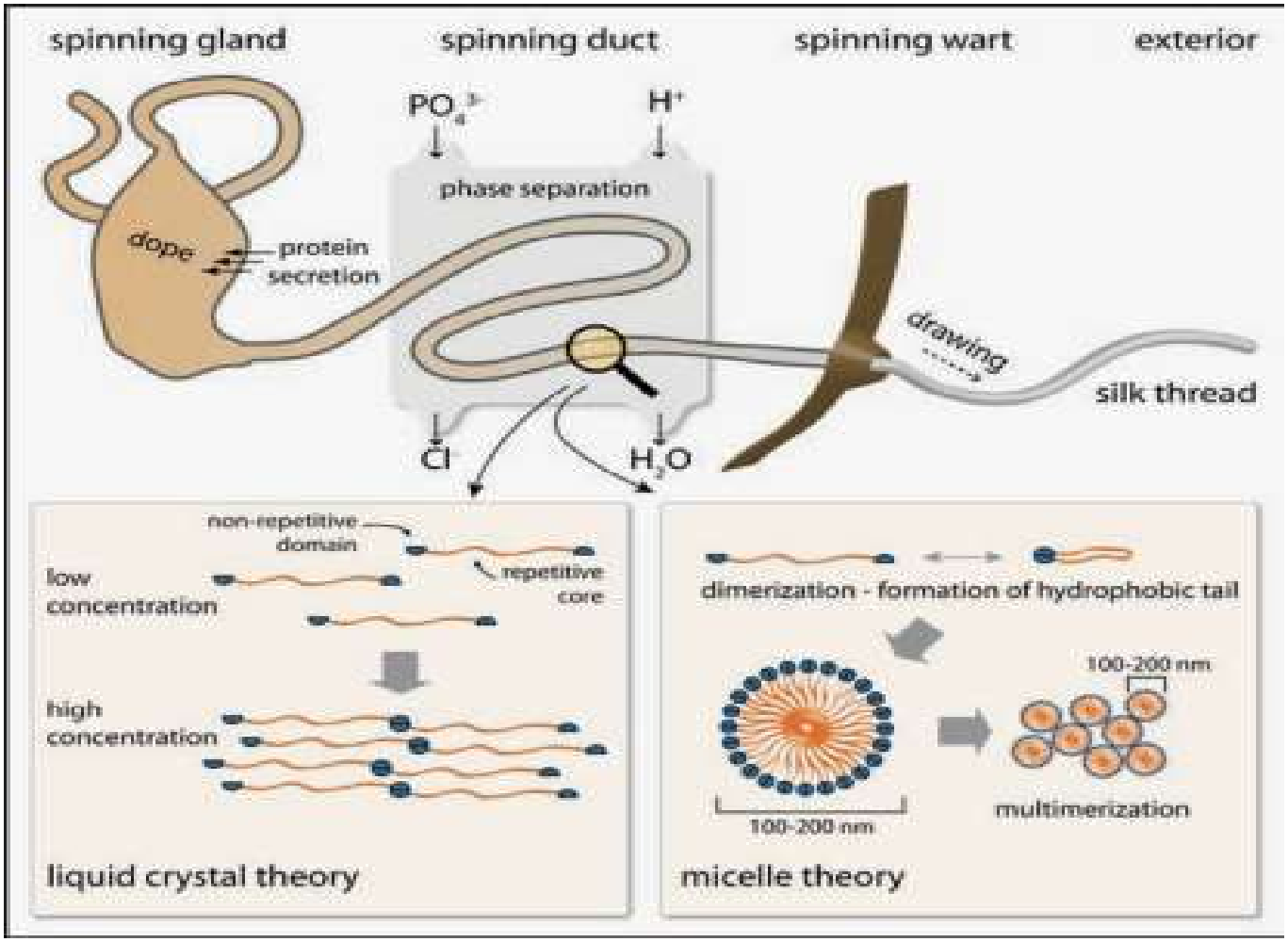


**Figure 4**

Model of the silk spinning process. The highly concentrated spider silk protein solution is secreted and stored inside the spinning gland. Upon initiation of thread formation, the solution is directed through a narrow ion exchange channel, in which a phase separation process takes place. Mechanical drawing of the silk thread (hind legs/gravity) results in rapid assembly of the silk fiber. Two theories exist concerning the molecular process inside the spinning duct. The first theory supports a liquid-crystalline behaviour of the silk proteins, whereas the other theory favors a micellar organization of the proteins, before elongation (through laminar force) finally leads to thread assembly.

## PHASE TRANSITION IN THE SPINNING DUCT: TWO THEORIES

Successful silk assembly is based on extending, aligning and packaging of individual silk proteins in the laminar flow inside the spinning duct. Hydrophobic residues (typically polyalanines of the repetitive core region) align upon multimerization initiated by the terminal domains and additionally by shear forces in the spinning duct. These polyalanine segments thereby expose an increasingly hydrophobic surface which triggers the formation of â-pleated structures with numerous intra- and interchain hydrogen bonds.

Two theories on the mechanism of silk fibre assembly have been proposed. One is based on the crystalline alignment of the underlying proteins in the laminar flow inside the spinning duct (Fig. 4). Monomers or disulphide-linked multimers pass the spinning duct at very high concentrations. The alignment in one direction together with the high concentration results in a liquid-crystalline like behaviour of the spinning dope. The proposed liquid crystalline state is the basis for the formation of intermolecular interactions like van-der-Waals forces and hydrogen bonds between neighbouring molecules. Upon further loss of solvent, the conformational conversion is finalized and a silk fibre can be drawn out of the spinning duct.

In the second model, silk proteins first assemble into small micelles with a diameter of approx. 100–200 nm due to their amphiphilic properties inside the spinning dope.[36] A multitude of these micelles form globules with diameters in the micrometer range (Fig. 4). Shear forces, which arise during passage through the spinning duct, force these globules into an elongated shape finally leading to fiber formation.

## MECHANICAL PROPERTIES OF SPIDER SILK

The most outstanding property of spider silk is its maximal resilience. Distinct spider silk threads are able to absorb three-times more energy than for example Kevlar, one of the sturdiest materials on a weight-to-weight basis (Table 1). It is interesting to note that synthetic materials typically show a higher stiffness and strength compared to natural fibers, whereas natural fibers tend to be more elastic. Synthetic carbon fibers, for example, have a yield point at approx 4 GPa. This is more than five times higher than the best insect silk. The elasticity of carbon fibers, on the other hand, is only marginal. As soon as a carbon fiber is elongated more than 1 percent or bent to a certain degree it will instantly break. Spider silk shows a well-balanced combination of strength and elasticity and therefore mechanically outperforms other natural fibers as well as synthetic threads under certain circumstances.

Mechanical properties of natural and synthetic fibers (taken from refs. [34] and [47])

| Material | Density [g $cm^{-3}$] | Strength [Gpa] | Elasticity [%] | Toughness [MJ $m^{-3}$] |
|---|---|---|---|---|
| MA Silk* | 1.3 | 1.1 | 27 | 180 |
| Flag Silk* | 1.3 | 0.5 | 270 | 150 |
| Insect Silk# | 1.3 | 0.6 | 18 | 70 |
| Nylon 6.6 | 1.1 | 0.95 | 18 | 80 |
| Kevlar 49 | 1.4 | 3.6 | 2.7 | 50 |
| Carbon Fiber | 1.8 | 4 | 1.3 | 25 |
| Steel | 7.8 | 1.5 | 0.8 | 6 |

Open in a separate window

*European Garden spider Araneus diadematus.
#Silkworm Bombyx mori.

In addition to its outstanding resilience, MA silk shows a torsional shape memory that prevents the spider from twisting and turning during its descent on a MA silk thread.[49,50] Interestingly, MA silk needs no extra stimulus for total recovery after being turned from its initial position. Instead, it scarcely oscillates after twisting because of its high damping

coefficient. Spider silk also shows a high super contraction rate.[51,52] Absorption of water leads to shrinkage and tightens the thread. This process is important to ensure the rigidity of the spider's web during its lifetime and is thought to be caused by the organization and arrangement of individual silk proteins.[53,54]

**SPIDER SILK vs INSECT SILK**

Spider silk is often compared to insect silk, preferably taken from the silkworm Bombyx mori. The commercially available silkworm silk is reeled from cocoons of caterpillar pupae. This process has only been slightly optimized over centuries and is highly cost-efficient. MA spider silk can be obtained by manually drawing the silk thread out of the spinning wart of immobilized spiders. However, this process is only suitable for MA silk (and not for the other spider silks), it is time consuming and highly expensive, especially since most spiders are cannibals, rendering farming costly.

The differences between insect and spider silks are evident on all levels, from the molecules involved to the structural arrangement of the proteins to the mechanical properties of the thread. On a molecular level, insect silk comprises a large amount of sericin-proteins, which are absent in spider silk. The proteins which are responsible for the fibrillar structure (so-called fibroins in insect silk) are, in contrast to spider silk spidroins, composed of light and heavy chain counterparts. Mechanically, silkworm silk is much weaker and less extensible as compared to for example MA silk of spiders. Interestingly, depending on spinning conditions, silkworm silk is either strong or elastic, whereas spider silk combines both properties.

Although the mechanical properties of both types of silk crucially depend on spinning conditions, it is primarily the proteins involved that make the real difference. Therefore, techniques have long been sought to recombinantly produce and engineer natural spider silk proteins.

**MIMICKING NATURE**

**RECOMBINANT SPIDER SILK**

Several biotechnological methods for recombinantly producing spider silk proteins have been analyzed during the last decades, since recombinant production of sufficient amounts of silk proteins is essential for understanding their structure and their assembly behavior.[48] Due to the highly repetitive character of individual spider silk molecules it is quite complicated to determine the complete cDNA sequence of a silk gene. As mentioned above only limited information about complete silk genes is available. Sequencing of repetitive proteins often gives incorrect or unreliable results, providing little information on gene size or the number of repeat units in particular.

The first attempt to obtain recombinant spider silk proteins was the direct transformation of original or fragmented silk genes into bacterial hosts. Bacteria, however, were not suitable for this task due to the large size of the genes. Recombinant production of spider silk proteins in bacteria has been further complicated by the different codon usage of spiders compared to bacteria. Thus, eukaryotic expression systems like the yeast Pichia pastoris were tested as expression hosts. Here, problems occurred during protein purification rather than during the production process. Similar problems were encountered upon attempts to use plants (such as potato or tobacco) as transgenic expression host, however, such systems are still under consideration since they appear to be attractive for larger scale productions.

Other expression systems for the direct transformation of spider silk genes/fragments have also been used during the last decades. The most prominent one is the expression of spider silk in the milk glands of transgenic goats by the Canadian company Nexia Biotechnologies. Although this technique initially produced promising results, the concentration of soluble protein in the milk was found to be low and the proteins could not be efficiently purified for thorough analysis. Tests were also performed in mammalian cell lines with comparable results.

Finally, insect cells which are phylogenetically closely related to that of spiders were employed using the baculovirus expression system. This particular system benefits from the fact that the easily modifiable baculovirus selectively infects insect cells. Partial cDNAs comprising the known carboxyterminal repetitive and nonrepetitive sequences of the two MA proteins of Araneus diadematus, ADF3 and ADF4, were cloned into the baculoviral genome. The recombinant virus was then used to infect insect cell lines (e.g., sf9 cells of the fall armyworm Spodoptera frugiperda or high five cells of the cabbage looper Trichopulsia ni). During cytoplasmic production, spider silk either remained soluble or assembled into solid fibers—depending on the type of MA silk protein A

great advantage of the baculovirus expression system, in comparison to expression in mammalian cells, is the relatively easy culturing process and the potential to easily modify the expression conditions. For large scale production, however, the Baculovirus system might be too inefficient and too expensive.

The difficulties encountered made it evident that a direct transformation of original silk genes and silk fragments is not the method of choice for recombinant spider silk protein production. To achieve stable production with efficient yields, i.e., by bacterial hosts, the spider genes must be adapted to the bacterial codon usage. To this end, genes coding for spider silk-like proteins were generated using a cloning strategy which is based on a combination of synthetic DNA modules and PCR-amplified authentic gene sequences.[28] This approach includes the carboxyterminal nonrepetitive regions present in all MA silks and the codon-optimized repetitive regions. Using a seamless cloning technique, a controlled combination of engineered modules as well as of authentic gene fragments without generation of unwanted gaps or artifacts inside the coding sequence is possible.[65] Employing this strategy, it was possible to dramatically increase the expression yields.[66] The modular system further enabled the production of special engineered proteins with tailor-made properties for experimental analysis.

## ARTIFICIAL SPINNING OF SPIDER SILK

Due to the availability of recombinant spider silk proteins, scientists will be able to analyze the assembly of spider silk threads in a functional in vitro spinning process in the near future. This process has to ensure that the generated silk fiber resembles natural silk in its microstructure, chemical composition and mechanical properties (Fig.4).

To adapt the sophisticated spinning machinery of spiders, several aspects have to be taken into account. Importantly, besides the protein composition of the spinning dope and the phase separation process in the spinning duct, several mechanical parameters play critical roles in silk assembly. In nature, spiders draw the thread with the hind legs (or by the force of gravity in case of roping) out of the spinning wart. This drawing process has been copied in the laboratory by forced silking of captive spiders. Analysis of the silking process revealed that spinning speeds range from 0.1 to 400 mm per second. Interestingly, large differences in resilience, ductility and thread diameters were reported depending on spinning speed and temperature.[55] It was shown that silks produced at higher reeling speeds have a slightly higher yield point, but are less extensible and weaker than silks spun at lower speeds.

Several attempts have been made to spin recombinant spider silk proteins for scientific purposes. At first wet-spinning processes were employed with promising results. Using silicon micro-spinnerets several meters of insect or spider silk fibers could be produced. Although the wet-spun silks visually resembled natural ones, their diameter was up to ten times bigger than naturally occurring silks leading to worse mechanical properties than found in natural silk fibers. Other attempts using special postspinning techniques yielded silks with even larger diameters. Until now, even the best mechanical properties obtained by artificial spinning techniques are much lower than that of natural dragline silks.

## EXCEEDING NATURE - PROTEINS AS POLYMER MATERIALS

Spiders mainly employ silk as linear thread. However, spider silk proteins have much more potential, because they can assemble in all three dimensions to build distinct macroscopic structures (Fig.5). Nowadays, several attempts are underway to employ silk proteins as biopolymer for novel materials.

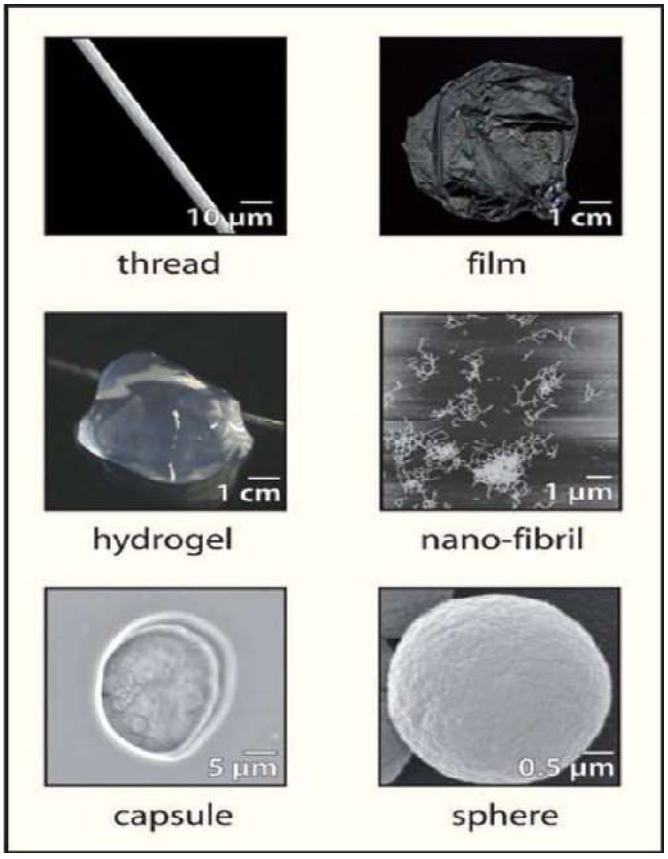


**Figure 5**

Possible shapes of spider silk. In nature, spider silk proteins are exclusively converted into silk threads. However, in vitro it is possible to transform silk proteins in other two- or three-dimensional shapes. The figure shows images of a capsule, a sphere, a thread and nano-fibrils (all electron microscopy), as well as a hydrogel and a film (photograph) made by recombinantly produced engineered spider silk protein.

For example, silk films can be made from a diluted spider silk solution. A silk protein solution is poured onto a surface and the solvent (e.g., water) is allowed to evaporate. During the evaporation process, the silk proteins assemble on the surface and form a sturdy, transparent film. The films can be manufactured with thickness from few nanometers to several micrometers sharing different chemical and mechanical characteristics, depending on the choice of solvent and environmental conditions. Although silk films themselves cannot fulfill the role of model systems for the assembly behaviour of all spider silk proteins, they give valuable insights into secondary and tertiary structure formation of these proteins under laboratory conditions. Analysis confirmed that MA proteins are intrinsically unfolded while in aqueous solution. Upon film formation, the proteins rapidly switch to a helical structure. Post treatment of the films with organic solvents like methanol resulted in further rearrangements of protein structure, increasing the â-sheet content dramatically.

In vitro spider silk is further able to self-assemble into small nanofibrils upon incubation in potassium phosphate buffer for several days at room temperature. The resulting fibrils are structurally comparable to amyloid fibrils.

Taken together, analysing the structure-function relationship of spider silk proteins in the near future will not only unravel the “secrets” behind the extreme toughness of silk threads, but will also help to engineer and design novel polymeric materials which are inspired by nature. The direct control of silk assembly will enable scientists to manufacture tailor-made spider silk materials with outstanding properties whose diversity cannot be achieved by conventional materials.

INTERNATIONAL UNION OF LEATHER TECHNOLOGISTS AND CHEMISTS SOCIETIES
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The Executive Committee of the IULTCS is pleased to announce the 2023 grants to be awarded to three young scientists, under the age of 35, for research projects in the categories:Basic Leather Research, Machinery / Testing and Sustainability / Environment – to be conducted at a recognised institution in 2023.

As in previous years Leather Naturally will again sponsor the Dr Mike Redwood Sustainability / Environment grant with the monetary sum of € 1,000 sponsorship and Erretre will similary sponsor the Machinery / Testing grant also with a sum of € 1,000 sponsorship and Erretre will similary sponsor the Machinery / Testing grant also with a sum of €1,000. In addition, IULTCS is delighted to receive the support of a new sponsor, Tyson Foods, who will provide a € 1,500 Basic Leather Research grant for research on the topics such as innovative leather processing, new chemicals for leather processing, analytical method development, hide/skin preservation, environmental studies applied to the tanneries, tannery waste treatment and basic research in collagen and leather.

2023 will be the ninth year of the grant and Professor Michael Meyer, Chairman of the International Union Research Commission (IUR) of IULTCS and Research Director at Freiberg (Germany) based FILK Freiberg Leather Institute expressed his appreciation of the continued engagement: “We are very happy to announce the award for the 9th year. The detailed project results of previous winners are presented in their reports on the IULTCS web site. It is worthwhile reviewing these substantial and significant investigations. We very much value the contribution of all sponsors to our YLSG programme. It is a vital instrument to encourage young leather scientists to acquire awareness and become more connected to the established research community of our industry. We have seen the programme growing stronger over the past years. Last year´s awards resulted in numerous, ambitious applications with innovative ideas and sustainable technologies.”

Application submissions for the 2023 YLSG programme open on 01 October 2022 and Luis Zugno, immediate past President and now secretary of IULTCS, asks young research talents of the industry to file innovative and thought-provoking project ideas before the 30 November 2022 deadline.

Details of the eligibility requirements are available on the IULTCS website YSLG_application_rules_and_procedure_2023.pdf (iultcs.org) The IULTCS requests that readers of this announcement forward the information to those institutions and individuals who could benefit from the award.

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INTERNATIONAL UNION OF LEATHER TECHNOLOGISTS AND CHEMISTS SOCIETIES

## INDIA CAN INCREASE FOOTWEAR EXPORTS BY 10 TIMES IN NEAR FUTURE: UNION COMMERCE MINISTER

India has immense potential in footwear sector and can increase the production and export ten times in near future, Commerce and Industry Minister Piyush Goyal said on Friday. He said this while virtually addressing 'Meet at Agra-Leather, Footwear Components & Technology Fair'.

Goyal said that about 7,000 small industries units are connected with the footwear sector which holds great significance to the economy and foreign exchange earnings of the country.

India is the 2nd largest producer of footwear and leather garment and can become world leader and accounts for nearly 3 billion square feet of world's tannery, he added.

He advocated for ethical and responsible practices — zero-waste discharge, salt-free tanning, and occupational health and safety interventions.

He said strong global branding through roadshows, electronic platforms and global joint ventures will help the sector make a mark globally.

Goyal also said that the Centre is working towards getting zero-duty access through Free Trade Agreements (FTAs) in leather goods, sportswear and footwear.

He added that all leading brands are dependent for raw material on India.

He urged the industry to prepare a plan so that Indian brands with high value projects find their way in the global market.

*(Source : Economic Times – 07/10/2022)*

## SOLAR AIR HEATERS TO HELP TANNERIES IN RANIPET-AMBUR REGION SAVE ON POWER BILLS

After much hesitation, tanneries in the Ranipet-Ambur-Vaniyambadi region have started taking baby steps to tap into solar energy to run automatic sprayer driers, vital for drying the processed leather, in their factories to cut down on the bi-monthly power bills.

A group of tannery owners came together at Overseas Leathers, a manufacturer and exporter of finished leathers, in the SIPCOT Complex in Ranipet on Wednesday to have a first hand experience of the operation of solar air heaters at tanneries. A Theni-based solar energy company, SunBest, provides technical support for these heaters.

At present, the leather-making region covers Ranipet, Walajah, Vellore, Ambur and Vaniyambadi. More than 500 tanneries are located in the region, with Vaniyambadi alone accounting for around 40% of the total number. Most of the tanneries are coal- or thermal energy-based factories, emitting greenhouse gases. Thermal energy accounts for around 55% of the total energy consumption for leather-making.

At the micro level, each drier at a leather unit consumes 20-25 units of electricity per hour. A tannery, on an average, runs at least three driers. In other words, around 600 units of power is consumed by the tannery every day. Officials said the power cost could be saved by switching over to solar energy. "Except during heavy rain, solar air heating panels can generate power to run driers. There won't be any fluctuation in solar power," says C.P. Rajkumar, CEO, SunBest.

Hans Raj Verma, CMD, Tamil Nadu Industrial Investment Corporation Limited (TIIC), and Ranipet Collector D. Bhaskara Pandian urged the leather manufacturers to go in for solar

energy. They said Tamil Nadu has the highest radiation of solar energy that could be utilised for industrial growth.

However, the installation cost of solar air heaters remains a major challenge for the leather manufacturers, especially small and medium entrepreneurs. They want the government to subsidise the cost.

*(Source : The Hindu.com – 20/10/2022)*

## MIKE REDWOOD PONDERS THE IMPORTANCE OF LOCATION FOR THE LEATHER INDUSTRY FROM TANNING CLUSTERS TO TRADE FAIRS.

(Credit: fuyu.liu/Shutterstock.com)

Around the world, we have many famous tanning centres, famous at least within the tanning industry. Alcanena, Himeji, Ranipet, Leon, Santa Croce sull'Arno, Arzignano, Sialkot and Igualada offer just a taste.

Hoover's *1937 Location Theory and the Shoe and Leather Industries*, which talks mostly about New England in the U.S. through the late 19th and early 20th century, is one of the seminal texts related to the study of industrial geography and helps understand the choice of location.

This might relate to raw material supplies or consumer markets and is impacted by things like technological advances. Consequently, locations will sometimes change and occasionally, like Bermondsey in the UK and Cordoba in Spain, become history.

A similar situation arises with trading cities like Bruges or Cadiz that lose relevance because ports silt up or trade moves elsewhere. Both Amsterdam and London were major markets for auctioning imported semi-tanned skins from India for nearly a century, and London stayed on as a location for a major trade fair but was eclipsed by Paris as the UK industry lost its access to colonial sources of raw material and felt the cost of new environmental laws.

So, for a period, the main leather fairs were in London, Paris and Italy. Italy has used Florence, Bologna and Milan in a bewildering way but has now settled happily in Milan. The U.S. also battled with locations with fairs in Boston, a brief attempt in Miami and has now settled in Portland.

But, towards the end of the 20th century, the big international leather fairs became undoubtedly APLF in Hong Kong and Lineapelle in Italy, with the huge size of the Chinese leather industry adding Shanghai into the mix for top tanners, traders and supply companies. Others in Paris, Chennai, Portland, Novo Hamburgo etc. have remained relevant but never commanded such a wide audience.

The problems created by Covid have led to better-quality video conferencing and associated software. That has changed how we do some kinds of work and meetings in the future but, even so, it has been clear that there is no substitute for face-to-face opportunities to improve almost every aspect of doing business. Events to be attended will be chosen more carefully and used more effectively, and likely fewer staff will attend, but actual meetings, formal and informal, are certainly back.

**Is Hong Kong dead as a meeting place for leather?**

The question is where these meetings will be. Chinese regulations on Covid have meant that APLF 2022 moved to Dubai and is currently testing Bangkok. These have been designed as experimental as well as keeping APLF and its great team alive in our reality; perhaps creating a new form of hub and spoke cluster with Hong Kong at the centre, but other locations used as trading groups emerge alongside new more resilient supply chains being set up post-pandemic.

Hong Kong itself has been a worry. One not helped by the rather aggressive Xi Jinping's two-hour speech opening the 20th National Congress of the Chinese Communist Party. Consequently, it increasingly looks as though both Hong Kong and Shanghai will disappear from the leather calendar as major event locations. Xi considers the changes in Hong Kong to have been a success and he will not change the zero Covid restriction policy.

In all areas, he doubled down on a more isolationist, anti-democratic and anti-Western policy. China is of course fully entitled to run itself as it chooses but, when Xi came to power, it was expected that China's steady integration into a global community of shared values would continue and it would become more dominant through its scale and economic wealth. Now, only partly catalysed by U.S. provocation during the last administration, he intends to be more than robust at home and abroad in making China strong on his own terms.

**Impact on leather**

Normally, such geopolitical moves have only a limited impact on the leather trade, but Taiwan is important for both footwear and leather with many close ties. Xinjiang has already created problems for many big leather customers who must find a way to comply with ESG audits and still sell to China, where a "wolf warrior" mentality is strong even within social media. And Hong Kong has been the leather industry's outstanding base for grasping the world picture and putting all strategic plans into a fully informed global context for over three decades. It offered easy access to international travel and great facilities: enjoyable cities make for better quality conversations

So, as the leather industry gathers for this APLF ASEAN Special Edition, with a backdrop of rising inflation, pending recession and also renewed political uncertainty going forward, it is the moment to check this to see if it fits the bill for future events.

*(Source : Internationalleathermaker.com – 19/10/2022)*

# Current Export Trends

**ANNEXURE– I**

## ANALYSIS – EXPORT PERFORMANCE OF LEATHER, LEATHER PRODUCTS & FOOTWEAR DURING APRIL-SEPTEMBER. 2022 VIS-À-VIS APRIL-SEPTEMBER. 2021.

As per officially notified DGCI&S monthly export data, the export of Leather, Leather products and Footwear for the period **April-September 2022 touched US $ 2841.52 Mn** as against the performance of **US $ 2261.17 Mn in April- September 2021**, recording growth of **25.67%**. In rupee terms, the export touched **Rs. 223162.63 Mn in April- September 2022** as against **Rs. 167135.99 Mn in April- September 2021**, registering a growth of **33.52%**.

**(Value in Million Rs)**

| CATEGORY | APR-SEP 2021 | APR-SEP 2022 | % VARIATION | % SHARE | % SHARE |
|---|---|---|---|---|---|
| FINISHED LEATHER | 16654.33 | 17633 .07 | 5.88% | 9.96% | 7.90% |
| LEATHER FOOTWEAR | 69382.41 | 100995.84 | 45.56% | 41.51% | 45.26% |
| FOOTWEAR COMPONENTS | 8912.54 | 11540.64 | 29.49% | 5.33% | 5.17% |
| LEATHER GARMENTS | 12865.17 | 15187.06 | 18.05% | 7.70% | 6.81% |
| LEATHER GOODS | 43370.96 | 55753.94 | 28.55% | 25.95% | 24.98% |
| SADDLERY AND HARNESS | 9807.76 | 10229.34 | 4.30% | 5.87% | 4.58% |
| NON-LEATHER FOOTWEAR | 6142.82 | 11822.74 | 92.46% | 3.68% | 5.30% |
| **TOTAL** | **167135.99** | **223162.63** | **33.52%** | **100.00%** | **100.00%** |

***Source: DGCI &S***

(Value in Million US $)

| CATEGORY | APR-SEP 2021 | APR-SEP 2022 | % VARIATION | % SHARE | % SHARE |
|---|---|---|---|---|---|
| FINISHED LEATHER | 225.23 | 224.92 | -0.14% | 9.96% | 7.92% |
| LEATHER FOOTWEAR | 938.76 | 1285.56 | 36.94% | 41.52% | 45.24% |
| FOOTWEAR COMPONENTS | 120.57 | 146.95 | 21.88% | 5.33% | 5.17% |
| LEATHER GARMENTS | 174.12 | 193.12 | 10.91% | 7.70% | 6.80% |
| LEATHER GOODS | 586.73 | 710.1 | 21.03% | 25.95% | 24.99% |
| SADDLERY AND HARNESS | 132.7 | 130.32 | -1.79% | 5.87% | 4.59% |
| NON-LEATHER FOOTWEAR | 83.06 | 150.55 | 81.25% | 3.67% | 5.30% |
| **TOTAL** | **2261.17** | **2841.52** | **25.67%** | **100.00%** | **100.00%** |

***Source: DGCI &S***

## MONTH WISE EXPORT OF LEATHER, LEATHER PRODUCTS AND FOOTWEAR FROM INDIA DURING APRIL TO SEPTEMBER 2022

(Value in Million US $)

| COMMODITY | APRIL 2022 | MAY 2022 | JUNE 2022 | JULY 2022 | AUG 2022 | SEP. 2022 | TOTAL EXPORT APR-SEP 2022 |
|---|---|---|---|---|---|---|---|
| FINISHED LEATHER | 42.73 | 37.44 | 38.53 | 34.49 | 36.54 | 35.18 | **224.92** |
| LEATHER FOOTWEAR | 192.66 | 201.54 | 220.18 | 244.49 | 218.9 | 207.77 | **1285.56** |
| FOOTWEAR COMPONENTS | 23.01 | 23.64 | 25.11 | 26.36 | 23.52 | 25.31 | **146.95** |
| LEATHER GARMENTS | 23.98 | 27.83 | 38.48 | 36.75 | 33.59 | 32.55 | **193.12** |
| LEATHER GOODS | 113.09 | 112.17 | 128.38 | 122.3 | 115.71 | 118.48 | **710.1** |
| SADDLERY AND HARNESS | 20.27 | 21.84 | 23.72 | 23.72 | 20.74 | 20.02 | **130.32** |
| NON LEATHER FOOTWEAR | 23.69 | 23.49 | 26.76 | 26.84 | 24.87 | 24.91 | **150.55** |
| **TOTAL** | **439.43** | **447.95** | **501.17** | **514.97** | **473.87** | **464.22** | **2841.52** |

***Source: DGCI &S***

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ANNEXURE– II

## ANALYSIS – COUNTRY WISE EXPORT PERFORMANCE OF LEATHER, LEATHER PRODUCTS AND FOOTWEAR FROM INDIA DURING APRIL-SEPTEMBER 2022 VIS-A-VIS APRIL-SEPTEMBER 2021

(Value in Million US $)

| COUNTRY | TOTAL | | | Share in total export APR-SEP 2021 | Share in total export APR-SEP 2022 |
|---|---|---|---|---|---|
| | APR-SEP 2021 | APR-SEP 2022 | % Change 2021 | | |
| U.S.A. | 505.35 | 701.57 | 38.83% | 22.35% | 24.69% |
| GERMANY | 253.77 | 309.02 | 21.77% | 11.22% | 10.88% |
| U.K. | 212.66 | 276.04 | 29.80% | 9.40% | 9.71% |
| ITALY | 141 | 189.71 | 34.55% | 6.24% | 6.68% |
| FRANCE | 125.64 | 138.38 | 10.14% | 5.56% | 4.87% |
| NETHERLANDS | 97.14 | 119.93 | 23.46% | 4.30% | 4.22% |
| SPAIN | 97.5 | 109.36 | 12.16% | 4.31% | 3.85% |
| BELGIUM | 55.28 | 73.9 | 33.68% | 2.44% | 2.60% |
| CHINA | 76.18 | 71.41 | -6.26% | 3.37% | 2.51% |
| U.A.E. | 50.09 | 58.29 | 16.37% | 2.22% | 2.05% |
| AUSTRALIA | 43.52 | 46.67 | 7.24% | 1.92% | 1.64% |
| DENMARK | 31.31 | 43.58 | 39.19% | 1.38% | 1.53% |
| POLAND | 38.42 | 41.8 | 8.80% | 1.70% | 1.47% |
| CANADA | 27.58 | 41.64 | 50.98% | 1.22% | 1.47% |
| JAPAN | 28.91 | 40.54 | 40.23% | 1.28% | 1.43% |
| PORTUGAL | 27.76 | 39.74 | 43.16% | 1.23% | 1.40% |
| VIETNAM | 27.89 | 34.57 | 23.95% | 1.23% | 1.22% |
| HONG KONG | 36.87 | 32.43 | -12.04% | 1.63% | 1.14% |
| AUSTRIA | 19.34 | 25.13 | 29.94% | 0.86% | 0.88% |
| KOREA REP. | 18.17 | 24.92 | 37.15% | 0.80% | 0.88% |
| SOMALIA | 12.07 | 23.95 | 98.43% | 0.53% | 0.84% |
| CHILE | 20.22 | 22.36 | 10.58% | 0.89% | 0.79% |
| SAUDI ARABIA | 12.64 | 19.06 | 50.79% | 0.56% | 0.67% |
| S. AFRICA | 16.84 | 18.4 | 9.26% | 0.74% | 0.65% |
| MEXICO | 15.36 | 18.31 | 19.21% | 0.68% | 0.64% |

(Value in Million US $)

| COUNTRY | TOTAL | | | Share in total export APR-SEP 2021 | Share in total export APR-SEP 2022 |
|---|---|---|---|---|---|
| | APR-SEP 2021 | APR-SEP 2022 | % Change 2021 | | |
| RUSSIA | 21.55 | 16.39 | -23.94% | 0.95% | 0.58% |
| SWEDEN | 15.1 | 15.23 | 0.86% | 0.67% | 0.54% |
| SWITZERLAND | 10.6 | 14.79 | 39.53% | 0.47% | 0.52% |
| MALAYSIA | 13.88 | 14.58 | 5.04% | 0.61% | 0.51% |
| TURKEY | 7.4 | 12.95 | 75.00% | 0.33% | 0.46% |
| SLOVAK REP | 8.8 | 11.74 | 33.41% | 0.39% | 0.41% |
| INDONESIA | 10.28 | 11.47 | 11.58% | 0.45% | 0.40% |
| ISRAEL | 7.87 | 9.01 | 14.49% | 0.35% | 0.32% |
| BANGLADESH | 6.96 | 8.7 | 25.00% | 0.31% | 0.31% |
| THAILAND | 8.76 | 8.67 | -1.03% | 0.39% | 0.31% |
| NIGERIA | 7.77 | 8.57 | 10.30% | 0.34% | 0.30% |
| FINLAND | 6.89 | 8.09 | 17.42% | 0.30% | 0.28% |
| HUNGARY | 11.68 | 6.49 | -44.43% | 0.52% | 0.23% |
| SINGAPORE | 5.79 | 6.37 | 10.02% | 0.26% | 0.22% |
| CZECH REP. | 5.08 | 5.43 | 6.89% | 0.22% | 0.19% |
| CAMBODIA | 2.35 | 4.87 | 107.23% | 0.10% | 0.17% |
| NEW ZEALAND | 5.09 | 4.78 | -6.09% | 0.23% | 0.17% |
| KENYA | 3.19 | 4.7 | 47.34% | 0.14% | 0.17% |
| GREECE | 3.07 | 4.69 | 52.77% | 0.14% | 0.17% |
| OMAN | 2.73 | 4.08 | 49.45% | 0.12% | 0.14% |
| NORWAY | 3.18 | 3.7 | 16.35% | 0.14% | 0.13% |
| TAIWAN | 3.26 | 2.88 | -11.66% | 0.14% | 0.10% |
| SRI LANKA DES | 3.31 | 2.71 | -18.13% | 0.15% | 0.10% |
| SUDAN | 3.39 | 1.09 | -67.85% | 0.15% | 0.04% |
| DJIBOUTI | 1.26 | 0.85 | -32.54% | 0.06% | 0.03% |
| OTHERS | 90.42 | 127.78 | 41.32% | 4.00% | 4.50% |
| **TOTAL** | **2261.17** | **2841.52** | **25.67%** | **100.00%** | **100.00%** |

***Source: DGCI &S***

The **Top 15 countries** together account about 80% of India's total leather & leather products export during April-September 2022 with export value of US $ 2261.84 Mn.

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**ANNEXURE– V**

## ANALYSIS–INDIA'S IMPORT PERFORMANCE OF LEATHER, LEATHER PRODUCTS AND FOOTWEAR DURING APRIL-SEPTEMBER 2022 VIS-À-VIS APRIL-SEPTEMBER 2021

As per officially notified DGCI & S monthly India's Import Data, the Import of Raw Hides & Skins, Leather, Leather products and Footwear for the period April-September 2022 touched US $ 797.36 Million as against the performance of US $ 509.65 Million in April- September 2021, recording a growth of 56.45%.

### INDIA'S IMPORT OF LEATHER, LEATHER PRODUCTS AND FOOTWEAR DURING APRIL-SEPTEMBER 2022 VIS-À-VIS APRIL-SEPTEMBER 2021

(Value in Million US $)

| CATEGORY | APR-SEPT. 2021 | APR-SEPT. 2022 | % VARIATION | % SHARE IN APR-SEPT. 21 | % SHARE IN APR-SEPT. 22 |
|---|---|---|---|---|---|
| RAW HIDES AND SKINS | 14.16 | 19.95 | 40.89% | 2.78% | 2.50% |
| FINISHED LEATHER | 175.19 | 262.66 | 49.93% | 34.37% | 32.94% |
| LEATHER FOOTWEAR | 151.32 | 249.54 | 64.91% | 29.69% | 31.30% |
| FOOTWEAR COMPONENTS | 12.33 | 19.67 | 59.53% | 2.42% | 2.47% |
| LEATHER GARMENTS | 1.15 | 0.46 | -60.00% | 0.23% | 0.06% |
| LEATHER GOODS | 21.46 | 27.93 | 30.15% | 4.21% | 3.50% |
| SADDLERY AND HARNESS | 1.4 | 1.68 | 20.00% | 0.27% | 0.21% |
| NON-LEATHER FOOTWEAR | 132.64 | 215.47 | 62.45% | 26.03% | 27.02% |
| **TOTAL** | **509.65** | **797.36** | **56.45%** | **100.00%** | **100.00%** |

***Source: DGCI &S***

India's Import of different categories of Footwear holds a major share of about 60.79% in India's total leather & leather product including Non-Leather Footwear with an Import value of US $ 484.68 Mn. This is followed by Finished Leather with a share of 32.94%, Raw Hides & Skins 2.50%, Leather Goods & Accessories 3.50%, Saddlery & Harness 0.21% and Leather Garments 0.06%.

### MONTH WISE IMPORT OF LEATHER, LEATHER PRODUCTS & FOOTWEAR FROM APRIL-SEPTEMBER 2022

(Value in Million US $)

| COMMODITY | APRIL 2022 | MAY 2022 | JUNE 2022 | JULY 2022 | AUG. 2022 | SEPT 2022 | TOTAL IMPORT APRIL-SEPT. 22 |
|---|---|---|---|---|---|---|---|
| RAW HIDES AND SKINS | 3.46 | 3.01 | 3.57 | 3.18 | 3.12 | 3.60 | **19.95** |
| FINISHED LEATHER | 46.52 | 44.99 | 47.89 | 40.76 | 46.21 | 36.36 | **262.66** |
| LEATHER FOOTWEAR | 29.94 | 32.71 | 43.57 | 41.36 | 50.53 | 51.45 | **249.54** |
| FOOTWEAR COMPONENTS | 2.63 | 3.88 | 2.97 | 4.12 | 3.38 | 2.69 | **19.67** |
| LEATHER GARMENTS | 0.05 | 0.05 | 0.06 | 0.11 | 0.09 | 0.11 | **0.46** |
| LEATHER GOODS | 4.51 | 4.61 | 3.73 | 4.98 | 4.5 | 5.59 | **27.93** |
| SADDLERY AND HARNESS | 0.28 | 0.25 | 0.37 | 0.33 | 0.23 | 0.23 | **1.68** |
| NON LEATHER FOOTWEAR | 27.9 | 27.2 | 38.32 | 40.02 | 46.58 | 35.63 | **215.47** |
| **TOTAL** | **115.29** | **116.7** | **140.49** | **134.86** | **154.64** | **135.66** | **797.36** |

***Source: DGCI &S***

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# Isolation and Identification of Bacteria adversely affecting hide and leather quality

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**Summary**

Two hundred and twenty five hide and chrome tanned leather samples were examined at different stages of processing to characterize the populations of organisms inhabiting them. Bacillus subtilis, Bacillus cerens, Bacillus pumilus licheniformis, Bacillus megaterium, Bacillus sphaericus, Micrococcus luteus, Staphylococous aureus Micrococcus rubens, Kurthia variabilis, Pseudomonas aeruginosa, Staphylococcus epidermids. Bacillus brevis. Micrococcus candidus, Micrococcus roseus, Bacillus firmus and Bacillus laterosporus were isolated and identified in different stages of tannery processing. Bacillus brevis, Bccillus cereus, Bacillus firmus, Bacillus laterosporus Bacillus licheniformis. Bacillus megaterium, Bacillus pumilus, Bacillus sphaericus, Bacillus sphaericus, Bacillus subtilis, Micrococcus luteus, Pseudomonas aeruginosa, Staphylococcus aureus and Staphylococcus epidermids were positive for gelatin hydrolysis.

Fresh and salted hide samples were also evaluated chemicaliy and histologically. Some of the salted hide samples showed histological changes resulting from poor curing techniques and high moisture content. It has been noted that generally Bacillus species caused deterioration of hides. It is concluded that the hide damage is caused by inadequate curing, bacterial action and autolysis.

## Introduction

Animal skin contains a great variety of microorganisms which are derived from air, water soil, manure and extraneous filth. While the animal is still alive most of these organisms have little effect on the skin, but after flay, these organisms find themselves in a perfect medium for growth and almost immediately start multiplying at the enormous rate.[1]

Leather damage that is the result of putrefaction in fresh hides include grain peeling, blister, pin prick and voids in the leather. The leather making process is therefore one in which organisms are important factors. Generally, but not always, microbial activity in leather making is harmful and has to be prevented or at least controlled.[2]

McLaughlin and Rockwel,[3] initiated the work by classifying the different types of microorganism present in hides and skins. Anderson[4] isolated and indentified the microflora of salted hide and calf skin and classified them in order of salt tolerance. Wood and his co-workers[5] studied the influence of storage conditions on the bacterial population of salted skins. The bacterial flora of fresh and salted skins as reported by other investigators, were found to vary but the organisms of the following genera, *viz,, Bacillus, Staphylococcus, Micrococcus, Sareina* and *Flavobacterium* have been isolated in most cases.

McLaughlin and Highberger[6]

carried out investigations on goat skins undergoing soaking with respect to the bacterial count of the skin cured by different methods and indicated that a high percentage of the organisms was of the proteolytic type. Identification of the organism present in soak liquor was not attempted. Line[7] examined various commercial bate liquors and found them to contain large numbers of bacteria. He identified the organisms and reported on the bacterial flora of the bate liquor which included organisms commonly found in soak liquors. Venkatesan and Nandy *et al.*[8] reported the changes in bacterial content in skin during beamhouse operation.

Cured hides contain substantial moisture. Studies on hide cure and evaluation include extensive discussion of the moisture content.[4,9] The amount of moisture in cured hides has a direct bearing on leather cost and quality.[10] Research and expeience have shown that cured hides containing more than 44% moisture are poorly protected and will deteriorate much more rapidly than cured stock with less than this.[11]

This research was done to determine bacterial flora, chemical and histological changes of the hide samples during the hide storage and hide processing in the Turkish Leather Industry.

## Materials and Methods

### Random hide samples for bacterial analysis

Pretanning processing was done according to the Turkish leather factory techniques. The hides used in these experiments were collected from slaughterhouses and tanneries. Hide samples consisting of 2 cm diameter plugs were taken from the tail area along the line of the backbone and about 15 cm in from the tail stub. These were taken from randomly selected newly slaughtered fresh hides ; 1 week and 2 months old salted hides ; soaked ; limed ; chromed ; retanned ; dried ; finished and 1 day and 2 months old leather. The sample of salted hide plugs from each batch was weighed and the plugs sliced into small pieces prior to adding to 100 ml sterile 7% or 0.85% saline. Each curing treatment sample was shaken for one hour in 100 ml sterile 7% saline in order to extract the bacteria from the hide. The liquid phase of the extract was diluted in 7% saline prior to plating on culture media, containing 0.85%, 7%, and 30% salt.[5] The bacteria were identified according to the Bergey's Manual of Systematic Bacteriology.[12]

### Pretanning operations

Samples were cut from freshly slaughtered cattle skin in aseptic condition, from which adhering blood and dirt were taken for bacterial examination. The rest of the skin was salted with re-used salt at random. Samples were cut after 1 week and 8 weeks of salting and the bacterial population was examined. After 1 month storage the hide was washed and soaked for 12 hours at 24°C and then put for liming.

A lime liquor was made up the following composition : 300% water, 3% sodium sulphide, 2% lime, 3.5% calcium hydroxide. Liming was continued for 68 hours with hauling and replacing twice a day. The pH of the liquor was 7.0 the hide was taken out, unhaired, fleshed and a sample was then taken for bacterial flora. The hide was then washed delimed with 1% ammonium sulphate and then bated with 12-13% pancreatic enzyme, 87% NaCl and 12% wood shavings at 25°C. The bated hide was then pickled in a liquor made up to 100% water, 1.5% sulfuric acid, 8% sodium chloride for 15 hours at 30°C. The pH of liquor was 2.8—3.2.[8]

**Media preparation**

The following solid media were used to isolate bacteria from the hide and leathers.

23.0 grams Nutrient Agar
5.0 grams Nutrient Gelatin
5.0 grams Beef Extract
1000 ml Water

In addition, each culture medium contained a specified amount of salt. All media preparations were autoclaved at least 15 minutes prior to pouring into sterile petri dishes. Media were stored under refrigeration until needed. A variety of incubation temperatures were tried at different stages of this research. Incubation of petri dish cultures in inverted positions helped to control moisture loss from the media. Humidity control was accomplished by large surface area open containers of water in the floor of the incubator. Plates were incubated at 25°C, 37°C and 41°C. Baterial growth was noted on solid media after more than two days incubation of culture.

**Gelatin hydrolysis**

A quick qualitative test for gelatin hydrolysis required only the solid media routinely used in this research, which already contained 0.5% nutrient gelatin. 5% trichloroacetic acid solution was flooded on the media after the colonies developed. The appearance of clear zones in the area around the colonies was interpreted as resulting from positive gelatin hydrolysis.[13]

**Chemical analysis of the hide samples**

Fresh and salted hide samples were evaluated chemically. A portion of each hide was cut into small cubes for determining moisture, total ash, ash moisture, brine saturation, pH, nitrogen and hide substance.

*Moisture content*

Small pieces of hide were cleaned thoroughly of hair, fat and dirt. The hide samples were then cut into small pieces. The sample is weighed before drying in a oven at 102°C for 4 hours. Dried hide samples were put into a dessicator for 30 minutes to cool. After cooling the samples again were put into a oven for 1 hour. The drying procedure was repeated until first weight is equal to second weight.[14]

*Hide cure evaluation*

The routine industry cure analysis was performed on hides to evaluate cure quality. Small pieces of hide were cleaned thoroughly of hair, fat and dirt. The hide sample was then cut into small chunks about 1 in. square. The sample is weighed before drying in a vacuum over at 80°C over an open dish of phosphorous pentoxide. Drying is typically done overnight. After weighing the cooled dry sample the hide material was carbonized in a flame to drive off smoke prior to ashing in a muffle furnace at 600°C until a constant weight is reached. Cure quality is assigned a value by dividing ash weight determined and further dividing this ratio by the theoretical value for a saturated brine when multiplied by 100 to express as a percentage, this cure value is often called per cent cure, but actually represent an expression of brine saturation.[13,15]

*pH*

5 grams of hide sample was cut into small pieces and transfered into a flask containing 10 ml water. The flask was shaken for 6 hours at 20°C. The pH of the extract was read with a pH meter.[16]

*Nitrogen*

Total nitrogen was done by the semi-micro Kjeldahl procedure: the small amount of ammonia was collected in N/100 sulfuric acid which was back titrated with N/100 sodium hy

droxide using methyl red as the indicator.[11]

**Hitological Evaluation**

Freshly slaughtered, 1 week and 2 months old salted hide samples were evaluated histologically. The histological rating was determined on cross sections stained with haemotoxylin and cosin on the basis of an examination of the following points : a) the condition of germinativum layer, b) the condition of fibroblasts, c) the condition of the epidermal cells, d) presence of voids in the epidermal area, e) the condition of collagen fibre bundles. A value of 3 was given for each of the points listed in which the cross section resembled that of a fresh hide. A value of 1 was given when the cross section showed marked deterioration. A value of 2 was given when the hide appeared to be intermediate in value between a fresh and a markedly deteriorated hide. A fresh or well preserved hide received, therefore, the maximum histological rating of 15 and badly deteriorated hide received the minimum rating of 5.[11]

**Results**

In this investigation, the distribution of various bacteriological species on the hides were evaluated. 225 hides and various leather samples in different stages of processing hides were examined. In this investigation, it is proved that many species of bacteria grow on the fresh salted hides and leather during tanning operations.

The warm and humid hides were contaminated with blood, dirt, manure, bacteria and protein. Slaughter houses were also generally contaminated. It was observed that hides were salted prior to being washed and were placed in the curing process without reduction of temperature and the curing salt was also contaminated. Thus, the growth and reproduction of bacteria were supported by faulty procedures.

The bacterial flora in skin after different beamhouse operations was studied. Fresh, salted and processed hide and leather samples were evaluated after 1 week of microbial development. The organisms identified are presented in Table 1. Even fresh cattle hides were found to be inhabited by a variety of organism. From 1 week old salted hides, several organisms like Bacillus brevis, Bacillus licheniformis, Bacillus pumilus, Micrococcus candidus, Micrococcus luteus, Micrococcus rubens and Staphylococcus epidermidis have been isolated in addition to the organisms already present in fresh skin.

The bact rial flora of week old and 2 months old salted hide were similar. After soaking, Bacillus brevis, Bacillus firmus, Bacillus pumilis, Bacillus sphaericus, Micrococcus candidus, Micrococcus luteus and Micrococcus rosaus present in salted hides were found to be absent. On the other hand two new organisms Bacillus laterosporus and Pseudomonas aeruginosa were isolated from the soaked hide.

25 limed hides were examined for their bacterial populations, four were sterile and the average decreased in this stage. Alkali-sulphide inhibits the growth of bacteria. Only spore forming organisms, such as genus Bacillus, survive in limed hides.

After liming the change in the microflora was quite significant. Five different species were isolated from the limed hides. All belong to the genus Bacillus., and all were proteolytic in nature.

25 chromed hides were examined. Seven of them were sterile. The bacterial flora of the chrome tanned hides were

similar to the limed hides. After chrome tanning Bacillus megaterium was found to be absent.

25 retanned hides were examined and 5 of these samples were sterile. Bacillus brevis. Bacillus cereus, Bacillus pumilus, Bacillus subtilis and Staphylococcus aureus were isolated and identified from retanned hides.

25 dried hide samples were examined and 10 of them were sterile. Bacillus bereus, Bacillus licheniformis, Bacillus subtilis and Micrococcus roseus were isolated and identified from dried hide samples. Bacillus brevis, Bacillus pumilus and Staphylococcus aureus present in retanned skin were found to be absent.

3 out of 27 finished samples were sterile. Bacillus megaterium has been isolated from finished hides in addition to the organisms already present in the dried hides, was found to be absent. Bacillus licheniformis, Bacillus pumilus and Bacillus subtilis were isolated from 1 day old leather and Bacillus licheniformis, Bacillus pumilus and Bacillus subtilis were isolated from 2 months old leather.

There were significant differences between salted, soaked, limed and chromed hide samples. The predominance of Bacillus indicated that the material was attacked by microflora characteristic of the first stage of hide deterioration when the water soluble compounds and the tannins are the main source of nutrition for microorganisms. Samples of cattle hides which have

TABLE I

Frequency of occurrence of various species of microorganisms at different stages of tanning

| Stage of tanning process | | Microorganism** | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| Fresh hides | 10 | *** | 4 | | | | 2 | | 3 | 7 | 1 | | | 2 | | | 2 | |
| 1 week old salted hides | 15 | 2 | 8 | | | 3 | 2 | 3 | 5 | 10 | 3 | 1 | 10 | 3 | 6 | | 7 | 3 |
| 2 months old salted hides | 25 | | 3 | 1 | | 4 | 7 | 4 | 8 | 24 | 1 | 1 | 5 | 6 | 3 | | 3 | 1 |
| Soaked hides | 25 | | 1 | | 1 | 1 | 6 | | | 9 | 1 | | | | 2 | 6 | 2 | 1 |
| Limed hides | 25 | | 2 | | | 4 | 1 | 6 | | 7 | | | | | | | | |
| Chrome tanned hides | 25 | | 14 | | | 2 | | 2 | | 1 | | | | | | | | |
| Retanned hides | 25 | 1 | 3 | | | | | 13 | | 12 | | | | | | | 1 | |
| Dried hides | 25 | | 3 | | | 3 | | | | 6 | | | | 1 | | | | |
| Finished hides | 25 | | 8 | | | 4 | | 6 | | 4 | | | | | | | | |
| 1 day old leather | 12 | | | | | | | 9 | | 9 | | | | | | | | |
| 2 months old leather | 13 | | | | | 2 | | 1 | | 5 | | | | | | | | |

*N : Number of hide samples/
**f : Average frequency/
*** : blank is equivalent to a 0

1. Bacillus brevis
2. Bacillus cereus
3. Bacillus firms
4. Bacillus laterosporus
5. Bacillus licheniformis
6. Bacillus megaterium
7. Bacillus pumilus
8. Bacillus sphaericus
9. Bacillus subtilis
10. Kurthia variabilis
11. Micrococcus candidus
12. Micrococcus luteus
13. Micrococcus roseus
14. Micrococcus rubens
15. Pseudomonas aeruginosa
16. Staphylococcus aureus
17. Staphyloccocus epidermidis

been limed chromed and dried were less contaminated than the fresh, salted and soaked hides.

The proteolytic activity of the organisms was examined on nutrient gelatin medium containing 0.5% nutrient gelatin. Gelatin hydrolysis by the organism of the genus Bacillus on the nutrient gelatin appears to be quite rapid. All species of the genus Bacillus, Micrococcus luteus, Pseudomonas aeruginosa, Staphylococcus aureus, Staphylococcus epidermidis were found to hydrolyze gelatin.

The chemical analysis of the cattle hides is given in Tables II. III, IV. Examination of the data for moisture content, total ash, ash/moisture content ratio, brine saturation, pH, nitrogen (KJLN), and hide substance show that there is a variation in composition from hide to hide.

In salted hides, the moisture content of the hide decreased as the hide substance increased. The ratio of the average hide substance to the average moisture content was 1 : 1.83 in fresh hides (Table II), in 1 week old salted hides 1 : 1.4 (Table III) and in 2 months old salted hides 1 : 1.1 (TableIV). It was concluded that these ratios reflected the autolysis process of fresh hides, 1 week old salted hides and two months old salted hides samples.

TABLE II

Chemical analysis of fresh hide samples

| Hide samples | Moisture % | Ash % | pH | Kjeldahl nitrogen % | Hide substance % |
|---|---|---|---|---|---|
| 1 | 63.95 | 0.22 | 6.68 | 4.39 | 24.67 |
| 2 | 62.21 | 0.90 | 7.00 | 4.39 | 24.67 |
| 3 | 54 60 | 0.60 | 6.67 | 7.21 | 40.52 |
| 4 | 64.49 | 0.25 | 6.41 | 7.64 | 42.94 |
| 5 | 60 02 | 0.47 | 6.61 | 4.95 | 27.81 |
| 6 | 64 01 | 0.23 | 6.70 | 4.56 | 25.63 |
| 7 | 63.02 | 0.50 | 6.71 | 5.70 | 32.03 |
| 8 | 62.06 | 0.47 | 6.31 | 6.31 | 35.46 |
| 9 | 59.07 | 0.46 | 6.68 | 7.25 | 40.74 |
| 10 | 63.09 | 0.57 | 6.90 | 7 46 | 41.92 |
| Average | 61.65 | 0.47 | 6:66 | 5.91 | 33.98 |
| Std dev | 3.02 | 0.21 | 0.20 | 1.35 | 7.58 |

TABLE III

Chemical analysis of 1 week old salted hide samples

| Hide samples | Moisture % | Ash % | Ash/ moisture % | Brine saturation % | pH | KJLN % | Hide substance % |
|---|---|---|---|---|---|---|---|
| 1 | 47.50 | 13.39 | 28.18 | 78.32 | 7.14 | 5.25 | 29.50 |
| 2 | 6.00 | 4.01 | 11.13 | 31.07 | 7.55 | 5.45 | 30.66 |
| 3 | 43.50 | 7.51 | 17.16 | 48.11 | 7.35 | 6.31 | 35.48 |
| 4 | 57.50 | 14.45 | 25.13 | 70.25 | 7.28 | 5.42 | 30.50 |
| 5 | 43.00 | 6.73 | 15.65 | 44.12 | 7.34 | 6.43 | 36.14 |
| 6 | 42.72 | 14.21 | 32.66 | 92.67 | 7.24 | 5.25 | 29.53 |
| 7 | 45.93 | 11.51 | 25.05 | 69.80 | 7.52 | 6,50 | 36.56 |
| 8 | 45.71 | 14.51 | 31.72 | 88.40 | 7.11 | 7.68 | 43.18 |
| 9 | 36.23 | 11.85 | 32.70 | 91.10 | 7.38 | 5.42 | 30.49 |
| 10 | 48.31 | 11.58 | 23.97 | 66.77 | 7.31 | 4.67 | 26.27 |
| 11 | 46.00 | 11.03 | 23.97 | 66.79 | 7.35 | 5.23 | 29.39 |
| 12 | 45.94 | 11.04 | 24.02 | 66.91 | 7.28 | 5.46 | 30,68 |
| 13 | 48.03 | 11.07 | 25.13 | 70.00 | 7.32 | 5.35 | 30.06 |
| 14 | 43,57 | 10 05 | 32.06 | 64.25 | 7.33 | 6.21 | 34.9 |
| 15 | 42.05 | 10 01 | 23.80 | 66.31 | 7.46 | 5.29 | 29.7 |
| Average | 44.80 | 10.93 | 24.27 | 67,66 | 7.33 | 7.73 | 32.2 |
| Std dev | 5.11 | 2.97 | 6.34 | 16.96 | 0.12 | 0.75 | 4.2 |

TABLE IV

Chemical analysis of 2 months old salted hide samples

| Hide samples | Moisture % | Ash % | Ash/ moisture % | Brine saturation % | pH | KJLN % | Hide substance % |
|---|---|---|---|---|---|---|---|
| 1 | 38.33 | 8.52 | 22.22 | 61.91 | 7.90 | 6.47 | 36.37 |
| 2 | 33.47 | 7.34 | 21.93 | 61.08 | 7.35 | 6.53 | 36.72 |
| 3 | 36.52 | 8.20 | 22.45 | 62.54 | 7.20 | 6.31 | 35.47 |
| 4 | 32.36 | 7.25 | 22.40 | 62.40 | 7.89 | 7.01 | 39.41 |
| 5 | 41.25 | 9.32 | 22.59 | 62.93 | 7.93 | 6.05 | 34.01 |
| 6 | 38.30 | 6.34 | 16.55 | 46.12 | 7.91 | 6.48 | 36.41 |
| 7 | 37.16 | 8.17 | 22.00 | 61.28 | 7.30 | 6.52 | 36.66 |
| 8 | 36.76 | 10.09 | 27.45 | 76.46 | 7.23 | 6.30 | 35.39 |
| 9 | 31.00 | 8.85 | 28.53 | 79.48 | 8.00 | 7.03 | 39.51 |
| 10 | 40.51 | 9.20 | 27.70 | 63.25 | 7.90 | 6.46 | 39.29 |
| 11 | 38.43 | 8.49 | 22.09 | 61.54 | 7.90 | 5.25 | 29.50 |
| 12 | 37.46 | 8.23 | 21.97 | 61.20 | 7.36 | 5.52 | 31.02 |
| 13 | 36.35 | 8.20 | 22.55 | 62.84 | 7.23 | 4.26 | 23.94 |
| 14 | 40.36 | 9.25 | 22.97 | 64.00.11 | 7.87 | 5.46 | 30.68 |
| 15 | 38.50 | 8.50 | 22.06 | 61.45 | 7.92 | 5.38 | 30.23 |
| 16 | 40.46 | 9.30 | 22.98 | 64.25 | 7.93 | 5.28 | 29.67 |
| 17 | 40.23 | 9.28 | 23.06 | 61.26 | 7.36 | 4.69 | 26.35 |
| 18 | 37.42 | 8.23 | 21.99 | 61.33 | 7.25 | 7.25 | 40.74 |
| 19 | 38.06 | 8.38 | 22.01 | 63.94 | 7.32 | 4.98 | 27.98 |
| 20 | 40.21 | 9.23 | 22.95 | 68.52 | 7.46 | 5.59 | 31.41 |
| 21 | 32.52 | 8.00 | 24.60 | 62.73 | 7.97 | 7.29 | 40.96 |
| 22 | 33.45 | 8.03 | 24.00 | 66.87 | 7.95 | 4.76 | 26.75 |
| 23 | 37.29 | 8.21 | 22.01 | 61.33 | 7.32 | 5.56 | 31.24 |
| 24 | 38.21 | 8.29 | 21.69 | 60.43 | 7.36 | 5.98 | 33.60 |
| 25 | 37.46 | 8.31 | 22.18 | 61.79 | 7.45 | 6.34 | 35.63 |
| Average | 37.28 | 8.45 | 22.72 | 63.24 | 7.61 | 5.95 | 33.44 |
| Std dev | 2.79 | 0.78 | 2.10 | 5.84 | 0.31 | 0.83 | 4.65 |

For grading, the cross sections were stained with haemotoxylin and eosin.[11] The histological grade of the hide samples is shown in Tables V, VI, VII.

There was no damage on the 10 freshly slaughtered hides when we graded the fresh hide samples. We observed that 8 hide samples were in good condition. The other samples were in fair condition. In the histological examination of a sample from each of 15, 1 week old salted hides, it was noted that 2 samples were in good condition, 8 samples were in fair condition, 5 samples were in poor condition. When the 25, 2 months old salted hides were examined histologically, it was noted that 6 hides were in good condition. 10 hides were in fair condition and 9 hides in poor condition. Taken together the results showed that some of the samples were poorly preserved, because of poor curing techniques. Also the use of dirty salt of improper particle size caused stains and defects with reduced the potential leather value.

Histologically, many changes, which were apparently autolytic and bacterial occured in the hide during 2 months storage. The corium showed much

TABLE V
Histological grades of fresh hide samples

| Hide Samples | Condition of Germinativum | Condition of Fibroblasts | Condition of Epidermal cells | voids in Epidermal area | Condition of Collagen fibre bundles | Total Grades |
|---|---|---|---|---|---|---|
| 1 | 2 | 2 | 2 | 2 | 2 | 10 |
| 2 | 3 | 3 | 3 | 2 | 3 | 14 |
| 3 | 3 | 3 | 3 | 2 | 2 | 13 |
| 4 | 3 | 3 | 3 | 3 | 3 | 15 |
| 5 | 3 | 2 | 3 | 3 | 2 | 13 |
| 6 | 2 | 2 | 3 | 2 | 3 | 12 |
| 7 | 3 | 2 | 3 | 2 | 2 | 12 |
| 8 | 3 | 3 | 3 | 2 | 3 | 14 |
| 9 | 3 | 3 | 3 | 3 | 2 | 14 |
| 10 | 3 | 2 | 2 | 2 | 2 | 11 |

Ratings : 1 = marked deterioration
2 = intermediate condition
3 = equivalent to a good fresh hide
Maximum rating is 15 (best), minimum = 3 (worst)

TABLE VI
Histological grades of 1 week old salted hide samples

| Hide Samples | Condition of Germinativum | Condition of Fibroblasts | Condition of Epidermal cells | Voids in Epidsrmal area | Condition of Collagen fibre bundles | Total Grades |
|---|---|---|---|---|---|---|
| 1 | 2 | 2 | 3 | 2 | 2 | 11 |
| 2 | 1 | 1 | 1 | 1 | 1 | 5 |
| 3 | 1 | 2 | 2 | 2 | 1 | 8 |
| 4 | 3 | 2 | 2 | 2 | 2 | 11 |
| 5 | 2 | 1 | 2 | 1 | 1 | 7 |
| 6 | 3 | 2 | 2 | 3 | 3 | 13 |
| 7 | 1 | 2 | 2 | 1 | 2 | 8 |
| 8 | 3 | 2 | 2 | 2 | 2 | 11 |
| 9 | 3 | 2 | 2 | 2 | 2 | 11 |
| 10 | 2 | 1 | 2 | 1 | 1 | 7 |
| 11 | 3 | 2 | 2 | 2 | 2 | 11 |
| 12 | 2 | 2 | 2 | 2 | 2 | 10 |
| 13 | 1 | 2 | 3 | 3 | 3 | 12 |
| 14 | 2 | 2 | 2 | 1 | 2 | 9 |
| 15 | 2 | 1 | 1 | 1 | 2 | 9 |

Ratings : 1 = marked deterioration
2 = intermediate condiiion
3 = equivelent to a good fresh bide
Maximum rating is 15 (best), minimum = 3 (words)

separation of fibre bundles and splitting up of the fibres. In addition, the fibre bundles on the flesh side appeared to be frayed and attacked. A definite loss of these fibre occured and varied from hide piece to hide piece.

**Discussion**

The extent of deterioration and the concentration of proteolytic enzymes present in a hide after post-mortem depends on a large number of factors, viz. time, temperature, number of bacteria present and intrinsic factors of the hide itself. To prevent putrefactinn during transit and storage, hides must be cured. A fresh skm when subjected to various operations prior to tanning, undergoes changes with respect to its bacterial population.

In this research, bacterial flora of fresh hides was low compared with the salted hides. The bacterial population of the hides increased because of contaminated salt. Also, the salt concentration in the salted hide was lower than it should have been. Re-used salt did not absorb water from hide, so that the bacteria found an available medium for growth, warm weather helped this reproduction and all of these circumstances increased the bacterial population on salted hides. Reduction in bacterial flora takes place by soaking the skin. This is because of the fact that a number of surface organisms are transfered the soak liquor. Liming of the skin for 68 hours with lime-sulphide liquor reduced bacterial flora to a very low level. Such a drastic reduction in bacterial population in limed hides is caused by the highly alkaline lime sulphide liquor.

The organisms which are salt resistant grow readilyon 0 85%.7%, and 30% salt containing media and adapt themselves gradually to the higher salt concentration. The list of organism tabulated in Table I gives a clear understanding of how the microbial flora of the hide changes at different stages of processing prior to the actual tanning operation.

7 different organisms belonging to 4 different genera have been identified from fresh hides, of which 5 possess gelatinolytic activity.

Kritzinger and Van Zyl[17] explained that the use of salt causes discoloration and that the salt could not absorb the water very rapidly and in adequate amounts from the hide.

Adamcic and Clark[9] isolated Pseudomonas aeruginosa from hide and state that the organism can damage collagen. Venkatesan, Wo ds and the others.[5,10,18,19,20] isolated Alcaligenes marshalli, Bacillus coagulans. Bacillus pantothenticum, Bacillus licheniformis, Bacillus cereus, Bacillus megaterium, Bacillus subtilis, Bacillus pumilus, Kurthia variabilis, Micrococcus roseus, Micrococcus rubens, and Staphylococcus from hides.

According to Bergmann[21] Sarcinae lutea, Sarcinae auriantica, Micrococcus roseus and Actinomyces bovis have been observed when the salted hide was stored in humid and hot weather.

In our study, 7 different microorganisms were isolated from the fresh hides and five of them possessed gelatinolytic activity. 14 microorganisms isolated from 1 week old salted nides were found to survive on the hides after 2 months of salting. In addition another proteolytic bacterium, Bacillus firmus, was also found to be present but Bacillus brevis was absent 2 months after salting.

After soaking, the bacterial flora of the hides was slightly modified by the addition of two new organisms, in common with

that of 1 week and 2 months old salted hides.

Bacillus fluorescens liquefacions, Bacillus megaterium, Bacillus subtilis, Bacillus anthrocoides, Bacillus fuscus, Bacillus mycoides, Bacillus liquidus, Bacillus gasoformans, Bacillus butyricus, Bacillus pumilus, Proteus vulgaris, Proteus mirabilis, Pseudomonas aeruginosa, Achromobacter iophagus and Alcaligenes marshallii have been isolated from soaked hides. Bacterial activity was seen at 5°C, when the temperature was increased by 1 or 2°C, the bacterial count in the soak liquor doubled. As a result, researchers have emphasised that the temperature of the soaking solution should not be more than 10°C.[8,21,25] In our research the process was continued for 12 hours and temperature was about 28°C in summer months.

After liming, the microbial flora of the skin changed appreciably. Five organisms, from the genus Bacillus appeared ; all produced gelatinases. This indicates that the spore formers may survive in limed pelt when lime and sodium sulphide are used for liming.

Nandy, Sen and Venkatesan[8] identified Micrococcus, Sarcina and Bacillus strains from old lime liquor.

In our study, the bacterial flora of the limed hide was studied and only the spore-bearing, rod-shaped organisms were present.

Researchers observed that three organisms Bacillus cereus, Bacillus subtilis and Bacillus megaterium are found to remain associated with the skin in all the stages from the green to limed hide.[8]

We observed that three organisms Bacillus cereus, Bacillus megaterium, and Bacillus subtilis are found to remain associated with the hide in all stages from the green to limed hide.

Once again the flora of the skin changes abruptly after the skin is chrome tanned. Four different Bacillus species have been isolated from chrome tanned hide and all of these bacteria were of the proteolytic type. Bacillus brevis, Bacillus firmus, Bacillus pumilus, Bacillus subtilis and Staphylococcus aureus have been isolated from retanned hides. After the drying process four different microorganism have been isolated from dried hides. Three of them belonged to Bacillus species.

After the finishing process, Bacillus cereus, Bacillus licheniformis, Bacillus pumilus and Bacillus sgbtils have been isolated.

The microbial flora of 1 day old leather was similar to that of 2 months old leather, and Bacillus species have been isolated from these lethers.

Anderson[4] observed that Bacillus subtilis and Bacillus mycoides can adapt themselves most rapidly to high salt concentration.

In our study we observed that Bacillus cereus, Bacillus cereus, Bacillus firmus, Bacillus licheniformis, Bacillus megaterium, Bacillus pumilus, Bacillus subtilis, Kurthia variabilis, Micrococcus lutyus, Micrococcus rubens, and Staphylococcus aureus have adapted to high salt concentration. Of the aerobic organisms possibly those belonging to the genus *Bacillus* are involved in a majority of the cases in the deterioration of hiddes and skins either in fresh or the salted condition, and also during beamhouse operation.

It has been suggested that salt cured stock should have a minimum ash to moisture content ratio of 31% at the time curing is completed and a ratio of 33% when received at the tannery[11]. This is proposed on the basis of the results obtained by various investigators and

TABLE VII

Histological grades of 2 months old salted hide samples

| Hide Samples | Condition of Germinativum | Condition of Fibroblastf | Condition of Epidermal cells | Voids in Epidermal area | Condition of Collagen fibre bundles | Total Grades |
|---|---|---|---|---|---|---|
| 1 | 2 | 2 | 2 | 2 | 3 | 11 |
| 2 | 1 | 1 | 1 | 2 | 2 | 7 |
| 3 | 2 | 2 | 2 | 2 | 2 | 10 |
| 4 | 3 | 1 | 2 | 2 | 2 | 10 |
| 5 | 2 | 1 | 2 | 2 | 2 | 9 |
| 6 | 1 | 1 | 1 | 1 | 1 | 5 |
| 7 | 1 | 1 | 2 | 1 | 2 | 7 |
| 8 | 3 | 2 | 2 | 2 | 2 | 12 |
| 9 | 3 | 3 | 2 | 2 | 2 | 12 |
| 10 | 3 | 3 | 2 | 2 | 2 | 12 |
| 11 | 1 | 1 | 2 | 2 | 1 | 7 |
| 12 | 2 | 2 | 2 | 2 | 2 | 10 |
| 13 | 2 | 2 | 2 | 2 | 2 | 10 |
| 14 | 2 | 2 | 2 | 2 | 2 | 10 |
| 15 | 2 | 1 | 1 | 1 | 1 | 6 |
| 16 | 3 | 3 | 3 | 2 | 2 | 15 |
| 17 | 2 | 2 | 2 | 2 | 2 | 10 |
| 18 | 1 | 1 | 1 | 1 | 2 | 6 |
| 19 | 2 | 2 | 2 | 2 | 2 | 10 |
| 20 | 3 | 3 | 2 | 3 | 2 | 13 |
| 21 | 2 | 2 | 2 | 2 | 2 | 10 |
| 22 | 3 | 2 | 3 | 3 | 3 | 14 |
| 23 | 2 | 1 | 2 | 2 | 1 | 8 |
| 24 | 1 | 2 | 2 | 2 | 1 | 8 |
| 25 | 2 | 2 | 2 | 1 | 1 | 8 |

Grades 12 through 15, 9 through 11, and 5 through 8 indicate that preservation was good, fair and poor respectively

Ratings : 1 = marked deterioration
2 = intermediate condition
3 = equivalent to a good fresh hide

indicates the necessity of moisture and ash analysis in the evaluation of hide and of cure. In our investigation, ash to moisture content ratio of 1 week old salted hides averaged was 24.27%. This ratio was 22.72% in the 2 months old salted hide samples.

Reserch results have showed that hides lost 50% dry weight as water during a 30 day salt cure[11]. In our study this value was 28.00% in the 1 week old salted hides and 39.5% in the 2 months old salted hide samples in this present study.

The condition of the hide at the time of removal must be such as to minimize the 'opportunity for microbial and enzymatic degradation. The equipment and surfaces in the slauhter house and during later handling must be clean and free of growth. The warm, wet hide can be chilled and even treated to

prevent growth of micro-organism. Certainly warm, wet hides should not be piled together so that heat is held in the hides further enhancing growth and activity.

Chilling should be done with chlorinated water or other anti-bacterial agents. Salt must be applied as promptly as possible after flaying, cleaning and fleshing in order to reduce the risk of even minor deterioration of the raw material.

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## FOOD INFLATION MAY LEAD TO DECEMBER INFLATION ABOVE 7%'

Elevated food price-led inflation triggered by unseasonal rains will become a sore point for markets and the policymakers going ahead, said analysts. India's retail inflation rate/consumer price inflation (CPI) surged to 7.41 per cent in September, mostly led by a higher food inflation rate that came in at a 22-month high of 8.6 per cent in the month gone by.

With this, the Reserve Bank of India has missed its inflation target for the third consecutive quarter. "The excessive rainfall in early October 2022 may adversely impact the kharif harvest and delay Rabi sowing, thereby posing a material upside risk to the food inflation outlook. However, the impact of the same on the year-on-year food inflation print is likely to be partly mollified by the high base that lies ahead for H2-FY23," says Aditi Nayar, chief economist at ICRA.

In 2019, unseasonal rains that were much lower in proportion had pushed food prices higher by 3 per cent over the four-months ended January 2020. However, food inflation cooled soon after, with vegetable prices significantly declining by March 2020. "Due to unseasonal rain patterns and frequency being witnessed across major states now, surge in food inflation may lead to inflation for December hovering above 7 per cent, and the quarterly average should come around 7 per cent, above RBI's projection of 6.5 per cent," says Soumya Kanti Ghosh, group chief economic adviser, State Bank of India.

"An eerie similarity with 2019 inflation trajectory could now mean that the RBI and market inflation estimates could go awry," Ghosh adds. At the global level, too, there is little respite. The recessionary outlook, analysts at Rabobank International said, though is putting a temporary cap on prices, La Niña is likely to result in adverse weather in key crop regions and prevent any big downside, which they believe is expected to remain until late Q1-CY23.

"The main concern is potential dryness over southern Brazil and Argentina that could affect a number of crops in the area, ranging from soybeans to coffee. Wheat prices still depend on the production and export capabilities of Ukraine," explains London-based Carlos Mera, head of the agri commodities markets at Rabobank International. "With the surge in Russian aggression, the grain deal will likely not be renewed when it is due in late November. This could keep wheat prices well supported and potentially push them higher going ahead," Mera adds.

All this, analysts believe, will keep the markets on edge as they were hoping that the global central banks, especially the US Federal Reserve and the RBI will go soft on rate hikes over the next few months as inflation comes under control. Rising crude oil prices, according to G Chokkalingam, founder and chief investment advisor at Equinomics Research, are another key monitorable.

"Brent oil price has jumped 18 per cent. While the Nifty valuation 18.6x FY24 (*estimated*) earnings per share of Rs 929 is reasonable, high oil and food prices pose a threat to inflation, which is a worrisome thing for the markets," says Chokkalingam. Technical analysts see the markets remain range-bound in the backdrop of domestic and global cues.

The Nifty, Nandish Shah, senior derivative and technical analyst at HDFC Securities believes, will find support at 16,800 levels for now. "The Nifty is likely to remain in a range of 16,800 to 17,300 for now. There are multiple supports for the index between 16,500-16,600 levels," says Shah. "In case the index breaks this on any major negative news," Shah adds, "it can then slip to 16,100 levels. That said, IT stocks are likely to provide support/cushion to the markets."

*(Rediff.com – 31/10/2022)*

## TWIN BLOWS: INFLATION RISES TO 7.4%, FACTORY OUTPUT SHRINKS

In twin blows to Indian economic revival, higher food prices drove retail inflation to a five-month high of 7.4 per cent while factory output fell for the first time in 18 months. The second consecutive month of rise in consumer price index (CPI)-based inflation will add to the pressure on the Reserve Bank of India (RBI) to again raise interest rates to tame high prices.

Inflation has been above the targeted zone for the ninth month in a row and as per statute, the RBI will now have to explain to the government in writing why it failed to keep prices below 6 per cent. Headline CPI inflation surged to 7.4 per cent in September from 7 per cent in the previous month, official data released on Wednesday showed.

**Higher inflation was led by food items.**

Food inflation surged to a 22-month high of 8.6 per cent while core inflation rose to a 4-month high of 6.3 per cent. This is the ninth consecutive month where the inflation print has remained above the upper band of 6 per cent and the second successive quarter where the average is higher than 7 per cent. Irregular rainfall is said to be the primary reason behind higher inflation in vegetable and fruits.

While inflation in cereals has also inched up, the steps taken by the government and a reasonably healthy Kharif output are expected to address the concerns behind the further hike in prices. Separately, the Index of Industrial Production (IIP) declined 0.8 per cent in August with heavy rains dampening construction activity and electricity demand, and the bleak manufacturing output belying the hope generated by the robust GST e-way bill data. "The combination of slightly higher inflation and fall in IIP raises concerns," said Nikhil Gupta, chief economist at Motilal Oswal.

"However, next month's data and US Fed's policy will decide whether we see 35 bps or 50 basis point hike by the RBI in December." Since April 2022, the RBI has increased the interest rate by 190 basis points in a bid to dampen demand. Official data released by National Statistical Office (NSO) on Wednesday showed that the retail inflation based on Consumer Price Index (CPI) was at 7.41 per cent in September as against 7 per cent in August.

**In year ago, same month, it was at a comfortable level of 4.35 per cent.**

The central government has mandated RBI to ensure that retail inflation remains in the range of 2-6 per cent. The Reserve Bank of India Act mandates the central bank to show up with a report to the government as to why it failed to contain inflation within the targeted band.

In September, RBI Governor Shaktikanta Das said acute imported inflation pressures felt at the beginning of this fiscal year have eased but it still remains elevated across food and energy items. "Another rate hike is certain in the December 2022 MPC (Monetary Policy Committee of RBI) review, after the uncomfortable inflation print of 7.4 per cent for September 2022.

"The quantum of the next rate hike will be determined by how much the inflation print recedes in October 2022, as well as the strength of the GDP growth for Q2 FY2023," said Aditi Nayar, Chief Economist at ratings firm ICRA. IIP contracted by 0.8 per cent in August, mainly due to a decline in output of the manufacturing and mining sectors.

Official data showed that the previous low in industrial output growth was a contraction of 3.2 per cent in February 2021. Factory output, measured in terms of the Index of Industrial Production (IIP), had expanded by 13 per cent in August 2021.

**The IIP grew by 2.2 per cent in July this year.**

The manufacturing sector shrank by 0.7 per cent in August 2022 compared to the 11.1 per cent growth recorded in the year-ago period, as per the data released by the Statistics and Programme Implementation Ministry. The power sector showed a growth of 1.4 per cent against a 16 per cent rise a year ago.

The mining sector witnessed a contraction of 3.9 per cent in August 2022, whereas there was a growth of 23.3 per cent in the year-ago period. During April-August this year, IIP rose 7.7 per cent against 29 per cent growth in the same period a year ago.

Capital goods output, which is a barometer of investments, rose five per cent in August 2022 compared to 20 per cent growth in the year-ago month. The consumer durables segment declined 2.5 per cent from 11.1 per cent growth a year ago. The primary goods segment, which accounts for nearly 34 per cent of the index, expanded 1.7 per cent in August compared to 16.9 per cent growth in the year-ago period.

The ministry said the growth rates over the corresponding period of the previous year are to be interpreted, considering the unusual circumstances on account of the COVID-19 pandemic since March 2020.

*(PTI – 12/10/2022)*

## WHAT IS A DIGITAL RUPEE? RBI DID PILOT LAUNCH ON NOVEMBER 1

The Reserve Bank of India (RBI) announced on Monday that from November 1, 2022, it will begin pilot launches of the Digital Rupee (eâ1) for specific use cases. According to the notification, the first Digital Rupee pilot will be in the Wholesale segment (eâ1-W) and will begin on Tuesday.

According to the RBI, the nine banks include State Bank of India, Bank of Baroda, Union Bank of India, HDFC Bank, ICICI Bank, Kotak Mahindra Bank, Yes Bank, IDFC First Bank, and HSBC. RBI, which has repeatedly expressed its opposition to private digital currencies, proposed to the government in October last year to broaden the scope of the paper rupee to include digital currency.

Union Finance Minister Nirmala Sitharaman had earlier announced that the RBI will launch a CBDC in 2022-23, which is the first official statement from the Union government on the much-anticipated digital currency's launch. According to the FM, the introduction of CBDC will boost the digital economy and will be based on blockchain technology.

**What is Central Bank Digital Currency (CBDC)?**

The Reserve Bank of India defines Central Bank Digital Currency (CBDC) as a digital form of legal tender issued by a central bank. Simply put, it is a digital form of fiat currency, i.e. The Indian Rupee. As a result, it can be exchanged for fiat currency one for one.

As per RBI, "CBDC is the legal tender issued by a central bank in a digital form. It is the same as a fiat currency and is exchangeable one-to-one with the fiat currency. Only its form is different." CBDC will have all of the advantages that we see with cryptocurrencies and digital forms of payment. To begin with, a digital currency can never be torn, burned, or physically damaged. They are also not physically lost. In comparison to notes, the lifeline of a digital form of currency will thus be indefinite.

The Digital Rupee will bring with it another significant advantage in terms of cryptocurrencies which is that it will be governed by a central authority, reducing the volatility risk associated with other digital currencies such as Bitcoin. The RBI has repeatedly expressed concerns about private cryptocurrencies such as Bitcoin, Ether, and others being used for money laundering, terror financing, and tax evasion. The introduction of its own CBDC has been viewed as a means of bridging the benefits and risks of digital currency.

*(Business Today – 31/10/2022)*

## RBI'S CENTRAL BOARD DISCUSSES PREVAILING ECONOMIC SITUATION, CHALLENGES


The 598th meeting of the central board was held under the chairmanship of Governor Shaktikanta Das, the RBI said in a statement. The Central Board of Directors of Reserve Bank of India on Monday reviewed the current economic situation and challenges being faced by the country due to global geopolitical crises.

"The Board in its meeting reviewed the current economic situation, global and domestic challenges including the overall impact of current global geopolitical crises," it said. The board also discussed the functioning of various sub-committees of the central board, ombudsman scheme and activities of select central office departments.

Directors of the Central Board — Satish K Marathe, S Gurumurthy, Revathy Iyer, Sachin Chaturvedi, Venu Srinivasan, Pankaj

Ramanbhai Patel and Ravindra H Dholakia — attended the meeting. RBI Deputy Governors Mahesh Kumar Jain, Michael Debabrata Patra, Rajeshwar Rao, and T Rabi Sankar, and Ajay Seth, Secretary, Department of Economic Affairs also attended the meeting.

*(Business Standard – 31/10/2022)*

## SUSTAINABILITY STANDARDS: FINMIN URGES BANKS TO INCENTIVISE MSMES


According to the latest data, outstanding credit to MSMEs jumped 24% as of August from a year before to Rs 18.16 trillion, partly aided by the Rs 5-trillion government's Emergency Credit Line Guarantee Scheme (ECLGS).

The finance ministry has advised banks to support those micro, small and medium enterprises (MSME) that have adopted certain sustainability standards for manufacturing with a raft of incentives, including cheaper credit, at a time when interest rates are on the rise, official and banking sources told FE.

The move is part of the government's broader efforts to encourage MSMEs to become "responsible manufacturers" and improve credit flow to these units that account for a bulk of the country's job creation. This policy also assumes significance in light of India's current negotiations with key economies like the UK and the EU for modern free trade agreements (FTAs) that tend to link market access with sustainable manufacturing practices.

MSMEs account for about 40% of the country's exports, 6% of the manufacturing GDP and almost 25% of the services GDP.In a letter to financial institutions, the department of financial services (DFS) has asked them to put in place policies, approved by their boards, for extending incentives to ZED-certified MSMEs. The ZED (zero defect, zero effect) certification is granted by the MSME ministry to those eligible units that comply with certain sustainability standards to not harm environment. The incentives that lenders are being advised to extend include concessional credit, lower loan processing fees and any other benefit that they deem appropriate.

The lenders have also been asked to ensure complete integration of the ZED portal with their online portal where MSMEs can apply for loans. "The MSME ministry had requested the DFS to advise financial institutions to help promote ZED-certified businesses. So, the DFS has advised lenders to put in place board-approved policies in this regard," one of the sources said.

So far, only 531 MSMEs have obtained ZED certification, according to the data available on the MSME ministry website, and the government intends to encourage a wider pool of small businesses to adopt such standards. According to the latest data, outstanding credit to MSMEs jumped 24% as of August from a year before to Rs 18.16 trillion, partly aided by the Rs 5-trillion government's Emergency Credit Line Guarantee Scheme (ECLGS).

In recent years, MSMEs have been hit hard by a combination of factors, such as demonetisation, the roll-out of the goods and services tax regime and, more recently, the pandemic. The Covid outbreak, particularly, caused a large number of MSMEs to sink, according to several analysts.

To soften the blow, the government came out with the ECLGS to facilitate guaranteed loans in the aftermath of the pandemic. In April, it approved a $808-million (Rs 6,062 crore) support to revitalise Covid-hit MSMEs through a programme backed by the World Bank. The government also announced the revamp of the extant Credit Guarantee Trust for Micro and Small Enterprises (CGTMSE) to facilitate an additional credit of as much as Rs 2 trillion. More recently, finance minister Nirmala Sitharaman asked private companies to clear dues to MSME suppliers within 45 days to improve the cash flow of these small businesses.

*(Financial Express – 31/10/2022)*

## RUPEE FALLS 30 PAISE TO 82.77 AGAINST DOLLAR

The rupee pared its initial gains and settled 31 paise lower at 82.78 (provisional) against the US dollar on Monday, tracking the strength of the American currency in the overseas market.


At the interbank foreign exchange market, the local unit opened at 82.35 and witnessed a high of 82.32 and a low of 82.80. It finally settled at 82.78 against the American currency, registering a fall of 31 paise over its last close of 82.47. The Indian rupee depreciated on Monday amid strength in the US dollar. However, positive domestic equities and weak crude oil prices cushioned the downside, said Anuj Choudhary - Research Analyst at Sharekhan by BNP Paribas.

Moreover, inflows by foreign investors supported the rupee at lower levels. "We expect the rupee to trade with a negative bias amid strong US dollar amid increasing odds of an aggressive rate hike by the Fed on Wednesday. Some recovery in crude oil prices may also weigh on Rupee," Choudhary added.

Traders may remain cautious ahead of manufacturing PMI and trade deficit data, which is expected to be released on Tuesday, Choudhary said, adding, "We expect USD-INR spot price to trade in the range of 81.80 and 83.30 in the next couple of sessions."

Meanwhile, the dollar index, which gauges the greenback's strength against a basket of six currencies, rose 0.28 per cent to 111.05.

Global oil benchmark Brent crude futures slipped 0.93 per cent to USD 94.88 per barrel. On the domestic equity market front, the 30-share BSE Sensex rose 786.74 points or 1.31 per cent to end at 60,746.59, while the broader NSE Nifty advanced 225.40 points or 1.27 per cent to 18,012.20. Foreign Institutional Investors (FIIs) were net buyers in the capital markets on Friday as they purchased shares worth Rs 1,568.75 crore, according to exchange data.

*(Business Today – 31/10/2022)*


**-: JILTA : -**

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# ILTA PUBLICATION

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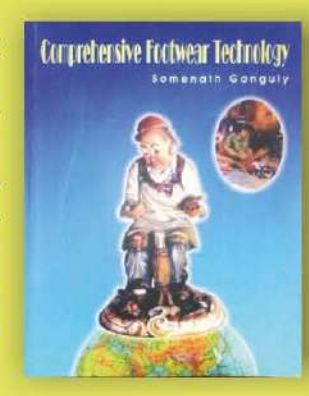


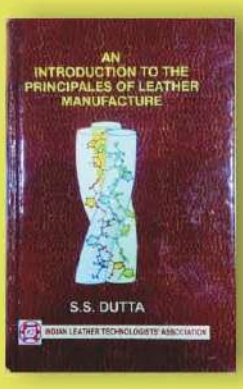


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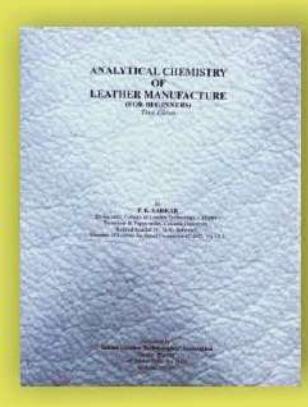



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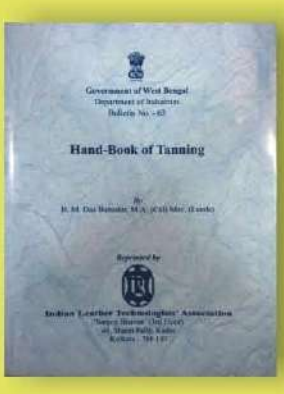


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Registration No. KOL RMS/074/2019-21

# History and Activities of Indian Leather Technologists' Association

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

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

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

INTERNATIONAL & NATIONAL SEMINAR

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

SEMINAR & SYMPOSIUM

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

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

It has also organized :

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

PUBLICATION

ILTA have published the following books :

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

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


AWARDS OF EXCELLENCE

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

LEXPOs

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

MEMBERS

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

ESTABLISHMENTS

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

ILTA
Since 1950

## Indian Leather Technologists' Association

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

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