



UNITED NATIONS  
INDUSTRIAL DEVELOPMENT ORGANIZATION

## Reducing the Pollution Load in Leather Processing Demonstrating

## Cleaner Technologies in Kanpur, India



INCLUSIVE AND SUSTAINABLE INDUSTRIAL DEVELOPMENT



**In an age of plastics, metals and synthetic, leather continues to be regarded as a product of superior quality. As a result, tanning – one of the oldest industries in the world which involves treating animal skins and hides to produce leather – remains an essential economic activity.**

## A booming industry that generates intensive employment

The leather tanning industry has witnessed a substantial explosion in India over recent decades. From a small exporter of raw materials in the 1960s, the leather industry now holds a prominent position in the Indian economy. It is among the top 10 foreign exchange earners for the country and employs around 2.5 million people.

## Negative impact on the environment

However, the industry is typically characterized by excessive water consumption and high levels of tannery waste produced by the leather industry. During the leather manufacturing process, tanneries use various chemicals to convert hides and skins into leather. If not properly treated, residuals from chemicals and other pollutants in tannery effluents are harmful to the environment.

The scarcity of natural resources and the accumulation of pollutants have required the development of technologies that are less detrimental to the environment.



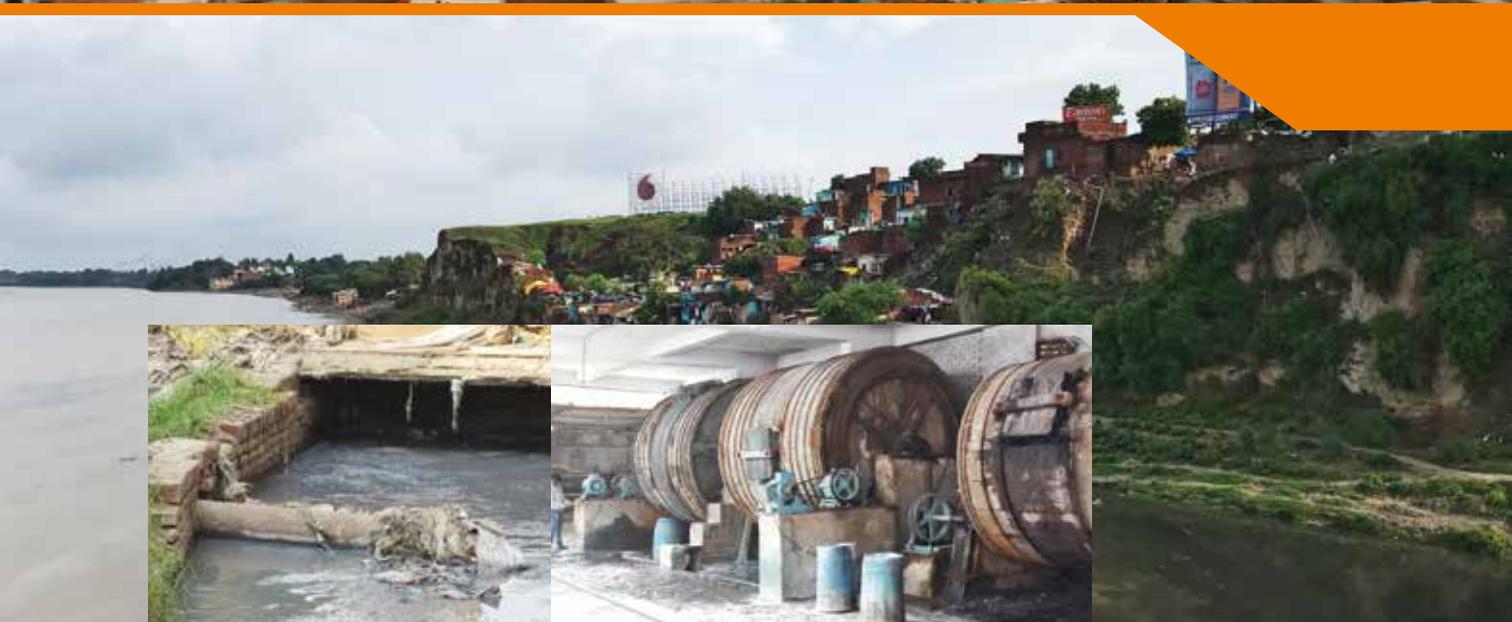
## THE RIVER GANGA ONE OF THE GREATEST RIVERS ON EARTH

- ❖ Covering a total distance of 2,510 km, the River Ganga (also known as Ganges) is one of the major rivers of the Indian subcontinent.
- ❖ It is critical to the health, prosperity, and spirituality of millions of people living on India's Northern Alluvial Plains. The river is used for drinking, power generation, irrigation, fish production, and religious pilgrimages.
- ❖ On the banks of the Ganga lies the holy city of Varanasi – one of the oldest continuously inhabited cities in the world and the oldest in India.
- ❖ Hindus, Buddhists and Jainists believe that Varanasi is the most sacred place on Earth to die. Up to 300 people are cremated there every day.
- ❖ The festival Kumbh Mela – the world's largest religious gathering – takes place every 12 years at the confluence of the Ganga and Yamuna rivers. An estimated 120 million attended the last festival in 2013.
- ❖ However, while it is revered in India, the Ganga also carries away the waste from the 450 million people who live in its catchment area.



## KANPUR THE CENTRE OF INDIA'S LEATHER INDUSTRY

- ❖ Located on the banks of the Ganga, Kanpur is one of India's biggest centres of trade and commerce.
- ❖ There are over 400 tanneries in Kanpur, which lies at the heart of India's vast leather industry.
- ❖ Kanpur's main leather products are: saddlery and harness leather; safety footwear; upholstery leather; army shoes; sole leather and footwear.



## ENVIRONMENTAL AND HEALTH IMPACT OF TANNERY WASTE DISPOSAL

- ❖ Pollution from the factories and farms of the world's fastest-growing large economy has turned the waters of the Ganga toxic.
- ❖ Effluents discharged into the river also contribute to the pollution. To address this problem, several effluent treatment plants have been constructed in the Jajmau region of Kanpur.
- ❖ Health hazards from the polluted water include respiratory disease, renal failure, and skin problems.
- ❖ Water used to irrigate farmlands in the Jajmau region of Kanpur is also found to have a devastating effect on crops and vegetables.

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By **2030**, the UN estimates that India will have about **1.45 billion inhabitants**, making it the world's most populous country.

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India is the world's largest democracy and also home to three of the **world's top 10 megacities: Mumbai, Calcutta and Delhi.**

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India has had an average **annual growth rate of about 7 percent** over the past five years.

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Increasing the Sustainability of the Leather Industry: UNIDO's Kanpur Leather Development Project (with financial support from the Swiss Agency for Development and Cooperation).

Recognizing the environmental threat posed by the leather tanning industry, in 2015 the Indian Government requested UNIDO to embark on an industrial scale demonstration project to increase the sustainability of the industry.

UNIDO considers proper training and capacity building activities in cleaner leather production technologies as an essential precondition for modern, sustainable leather processing.

This project therefore uses a range of cleaner technologies in leather processing to help tanneries mitigate the environmental impact of the leather processing operations. These technologies reduce pollutant emission levels and/or characteristics and include

the following methods: hair save unhairing; water measurement systems; solar water heating; solar air heating; alternative preservation methods; and desalting.

#### PROJECT GOALS

- Promote environmental sustainability and greater production efficiency and best practices in leather processing;
- Enhance waste management by reducing the amount of pollution generated at source and containing the impact of waste on the environment;
- Create employment and income opportunities in local leather-based industry; and
- Contribute to the enhanced performance of local small and medium-sized enterprises (SMEs), thus ensuring their sustainable inclusion in domestic and international supply chains.

**PROJECT BENEFICIARIES**

Small and medium-size tanneries, tannery workers, and residential areas near the tanneries.

**DEMONSTRATING THE EFFECTIVENESS OF CLEAN TANNING TECHNOLOGIES**

A lack of awareness in Kanpur about the benefits of these technologies or concerns about the impact they might have on leather quality has meant that they have not been widely adopted. UNIDO therefore decided to demonstrate, in cooperation with volunteer tanneries in Kanpur, how these cleaner and more energy efficient technologies work. Six pilot demonstration units (PDUs) have been developed to serve as “Show-How” models, illustrating various cleaner technologies.



These technologies are described briefly over the next few pages.

**More information is available in the Fact Sheets located at the back of this brochure.**

**WASTE MANAGEMENT EDUCATION AND TRAINING**

In its first year the project has also:

- Developed comprehensive waste management plans for the leather industrial clusters;
- Introduced an e-learning platform at KLC Institute in Kanpur. Course materials are already available at the institute for future training programmes. As project activities continue to develop, the KLC Institute is expected to play a lead role in providing professional and vocational training. To date, a pilot blended **e-Learning course** has been organized for **50 participants** from the Jajmau-based tanneries. The course was prepared jointly by UNIDO, KLC, Common-Sense and the University of Northampton, UK; and
- Organized various **workshops, seminars and practical training activities** for technicians, managers and operators from tanneries. More than **800 participants** have already benefited directly from these activities.



## PDU1

### Hair Save Unhairing/ Liming Background

Unhairing/liming removes hair from the pelt without damaging it. This is achieved by destroying or loosening the hair shaft from the hide surface and removing it in one of two ways: either using chemicals (a mixture of sulphide and lime) or filtration (hair saving).

Sulphide and lime have been used in tanneries since the 1880s to destroy the hair. Dissolving the hair pollutes the waste water. The hair-save unhairing method employed in this project significantly reduces this pollution. After loosening the hair in the liming/unhairing bath, it is filtered out using a hair filtering machine before it can dissolve.

#### RESULTS AND BENEFITS

- ❧ Less environmental contamination: Fewer chemicals result in less hazardous waste and pollution in wastewater;
- ❧ Financial savings: Reduced environmental costs related to treatment and disposal of wastewater and sludge;
- ❧ Agricultural uses: Tannery hair can be used as liquid fertilizer; and
- ❧ Reduced energy consumption: Virtually no energy input is required and this is an easy technology to control.

## PDU2

### Water Mixing and Measurement Background

The global leather industry requires an estimated 30 billion litres of water annually.

By acting as a medium between the hides/skins and chemicals, water removes undesired materials and facilitates the reaction between the chemicals and the hides/skins. Excessive water usage resulting from traditional processing methods and equipment can cause water shortages as well as effluent treatment problems. In many tanneries in Kanpur, the amount of water added to processing vessels is judged visually rather than actually measured. This often results in significantly higher water consumption than the actual requirement. Under the project, three different types of water measurement systems have been used: water flow meters; electromagnetic flow meters with batch control; and automatic water addition/mixing systems.

#### RESULTS AND BENEFITS

- ❧ Water savings: 20 to 30 percent reduction in the amount of water used. Further reduction through various water management techniques such as using drums for soaking/liming, recycling waste streams, and reusing certain tannery liquors;
- ❧ Less pollution: Up to 15 percent less chemicals used, especially after tanning;
- ❧ Financial savings: Lower cost of effluent treatment and greater treatment efficiency; and
- ❧ Better quality: More consistency in the quality of leather produced.

## PDU3

### Solar Water Heating System

#### BACKGROUND

The tanning industry uses a considerable amount of hot water, especially during curing, tanning and dyeing. Until now, the industry has been heating water with fossil fuels, gas oil and natural gas, either with a conventional boiler or, in certain locations, through the production of electricity using waste heat (like steam). New technologies are now available for the industry to produce hot water in tanneries. This project uses thermal solar energy to produce hot water. Indian tanneries in Kanpur are suitably located for the application of the solar water heating systems since the city has an average of 270 sunny days every year.

#### RESULTS AND BENEFITS

- ❖ Less reliance on fossil fuels: The reduced demand for steam leads to a decrease in the boiler's coal consumption. For every square metre of the solar collector area, about 200 kg of coal can be saved;
- ❖ Reduced energy costs, carbon emissions and greenhouse gases: The solar water heating system can save up to 8 MJ of energy per square metre of finished leather. This can reduce overall energy consumption by 17 percent; and
- ❖ Lower chemical consumption: Increased uptake of chemicals as a result of hot water use in leather processing.

## PDU4

### Solar Air Heating System

#### BACKGROUND

The main energy consuming equipment in a tannery is the tunnel dryer. During automatic spraying and roller coating, the leather is dried using hot air of 80 – 90° C from steam or hot thermal oils produced by burning fossil fuels. An alternative technology demonstrated by the project is a solar air heating system. After collecting ambient air on the roof top, the system heats it up using solar energy and applies the heat directly into the tunnel driers.

#### RESULTS AND BENEFITS

- ❖ Less reliance on fossil fuels: About 230 kg of coal can be saved for every square metre of the solar collector area, resulting in a large saving in energy;
- ❖ Notable energy savings: The system can save up to 10 MJ of energy per square metre of finished leather. This can reduce overall energy consumption by 20 percent; and
- ❖ Less greenhouse gases: Reduction in carbon dioxide emissions of up to 114 tonnes per annum.

## PDU5

### Processing Fresh Chilled Hides

#### BACKGROUND

The preservation and tanning processes of raw hides and skins often involves the extensive use of salt, especially sodium chloride and sodium sulphate. Salt in the effluent is very difficult to remove from the wastewater, and can cause land degradation and pollution of the underground water. The project uses cost effective curing methods which are environmentally safer and do not adversely affect the quality of the leather produced. The raw hides and skins can be preserved by chilling them for a certain period without using salt.

#### RESULTS AND BENEFITS

- Major environmental savings: 30 to 40 percent reduction of salt and other dissolved solids discharged in wastewater.

## PDU6

### Desalting

#### BACKGROUND

Wet salting is one of the most commonly used hide and skin curing practices in the world. Removing excess salt from wet salted hides and skins leads to a decrease in the amount that enters the wastewater and the environment. Under the project, two different methods – salt shaker and a brush type desalting machine – are used to remove excess salt.

#### RESULTS AND BENEFITS

- Less pollution: Between 15 and 20 percent reduction in salt in tannery wastewater.
- More efficient soaking: Loose salt and other impurities are removed during desalting.

## Moving Forward

Building on the success of the first year, future project actions are expected to involve more stakeholders such as associations, institutes, special purpose vehicles and the leather industry. The focus will be on:

- Adopting cleaner technologies on a wider scale;
- Processing chilled hides without salting, to the greatest extent possible;
- Treating effluents and continuously monitoring their impact on the environment;
- Adopting best practices in the industry; and
- Establishing solid waste management facilities.









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