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**TANNERY WASTE MANAGEMENT AND THE ENVIRONMENT**

*BY*

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**National Environmental Standards and Regulations Enforcement Agency  
(NESREA)**

**ONE-DAY SEMINAR**

**ON**

**INTRODUCTION OF PILOT BIOGAS PRODUCTION FROM TANNERY EFFLUENT  
FOR ELECTRICITY GENERATION**

**AT**

**ROYAL TROPICANA HOTEL, NIGER STREET, KANO**

**ON**

**TUESDAY 30<sup>TH</sup> NOVEMBER , 2021**



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**OUTLINE OF PRESENTATION**

- **INTRODUCTION**
- **IMPACTS OF TANNERY WASTE ON THE ECOSYSTEM**
- **INDISCRIMINATE DISPOSAL OF TANNERY WASTES**
- **WASTE MANAGEMENT**
- **NESREA: INSTITUTION AND STATUTORY MANDATE**
- **NESREA STRATEGIES**
- **REGULATORY PROVISION**
- **SUSTAINABLE DEVELOPMENT**
- **CONCLUSION**



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## INTRODUCTION

- Tanning is the process of converting hide and skin into leather by soaking it in some chemicals (chromium, tannic acid)
- Leather is a globally acclaimed product.
- The current trade value approximately US\$ 70 billion per year.
- About 18 billion square feet of leather produced yearly,
- About 65% of the world production of leather is estimated to go into leather footwear.
- The quantity of water used in processing a kg of hide/skin is about 30–35 liters.
- Out of 1000 kg of raw hide, nearly 850 kg is generated as solid wastes in leather processing. Only 150 Kg of the raw material is converted in to leather.





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## INTRODUCTION Cont.



- A typical tannery generate huge amount of waste:
- Fleshing: 56-60%
- Chrome shaving, chrome splits and buffing dust: 35-40%
- Skin trimming: 5-7%
- Hair: 2-5%
- Over 80 per cent of the organic pollution load in BOD terms emanates from the *beamhouse* (pre-tanning); much of this comes from degraded hide/skin and hair matter. During the tanning process at least 300 kg of chemicals (lime, salt etc.) are added per ton of hides. Excess of non-used salts will appear in the wastewater.


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### INTRODUCTION Cont. POLLUTION LOAD

Example of mass balance of chemicals in leather processing kg/ tonne of wet-salted hide			
Chemicals	Added in process	In/on leather & splits	Wasted
Chrome oxide, Cr <sub>2</sub> O <sub>3</sub>	25	12	13
Organic tannins	25	20	5
Fat liquors	22	17	5
Dyestuffs	5	4	1
Acids, bases, salts	191	-	191
Tensides	3	-	3
Enzymes	5	-	5
Finishing products	100	12	88
<b>Total</b>	<b>452</b>	<b>72</b>	<b>380</b>

**Table 1. An example of mass balance in leather processing**


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### IMPACTS OF TANNERY WASTE ON THE ECOSYSTEM

- Tannery wastewater and solid wastes often find their way into surface water, where toxins are carried downstream and contaminate water used for bathing, cooking, swimming, and irrigation. Chromium waste can also seep into the soil and contaminate groundwater systems that provide drinking water for nearby communities. In addition, contamination in water can build up in aquatic animals, which are a common source of food.
- Leather industry has negative impacts due to the pollution it adds to the environment. Chromium, one of the hazardous pollutants discharged from tanneries, is highly toxic and carcinogenic in nature.

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### INDISCRIMINATE DISPOSAL OF TANNERY WASTES

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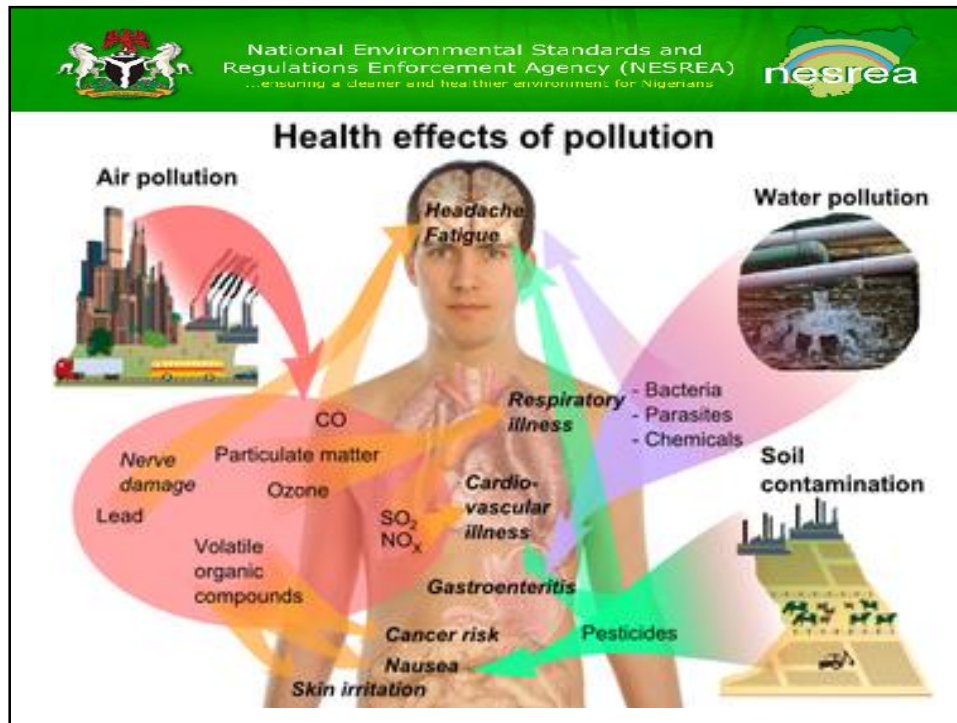
### INDISCRIMINATE DISPOSAL OF TANNERY WASTES

Waste water from the facility passing through the community

Effluent flow path in the community










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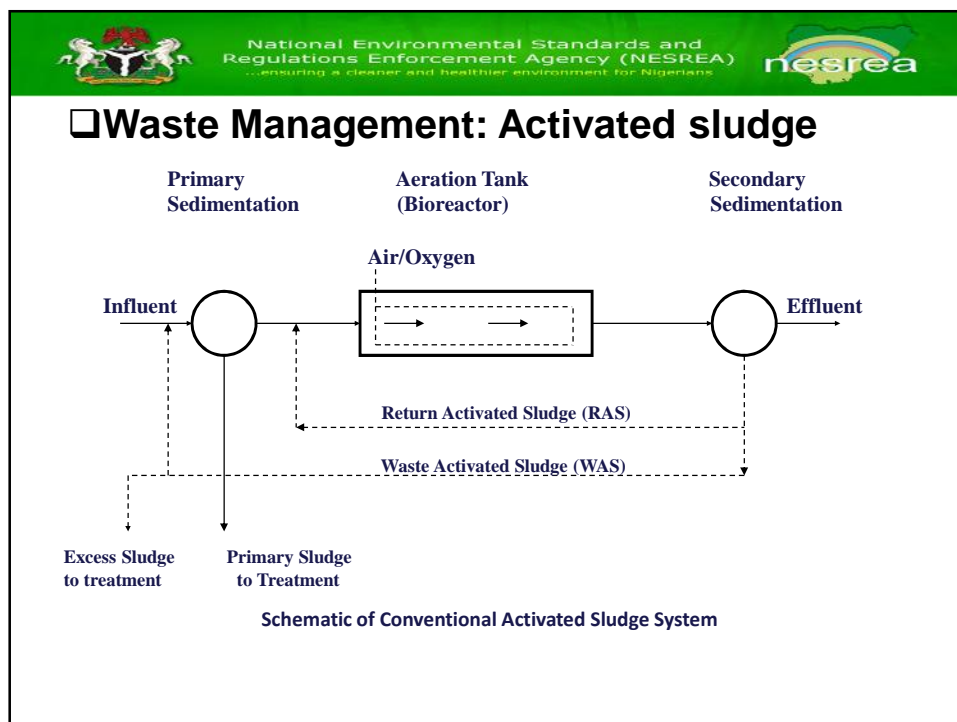
## WASTE MANAGEMENT

- Solid wastes
- ISWM hierarchy: Elimination/minimisation, recycling & reuse, transformation, landfilling
- Waste minimisation
- Recycling and reuse (hair, chromium, salt recovery)
- Waste transformation (pyrolysis or incineration with/without energy recovery)

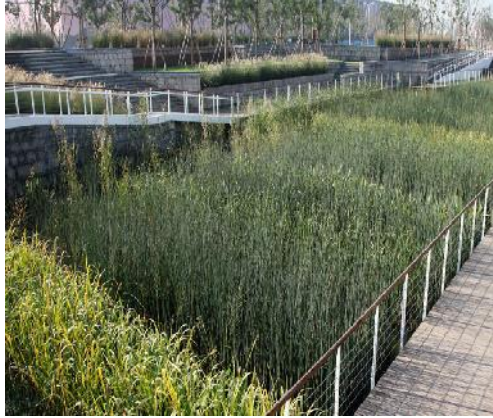

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## Waste Management (cont.)

- Liquid wastes: wastewater
- Biological, chemical and physical methods
- Sustainability: biological methods preferred
  - Activated sludge
  - Macrophytes and algal systems
  - Anaerobic digestion (energy generation potentials)
- Physico-chemical methods (filtration, coagulation, precipitation, ion exchange)



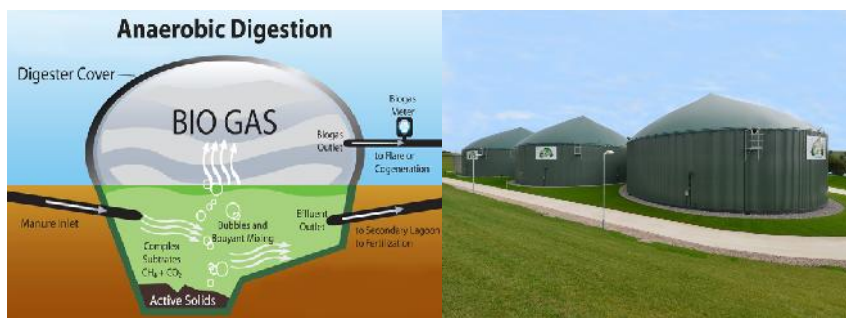
## ❑ Waste Management: Constructed wetlands



Credit: Turenscape, Shanghai


- ❑ Macrophytes
- ❑ Horizontal flow
- ❑ High BOD, COD,  $\text{NO}_3$ ,  $\text{PO}_4$  rem. (Terfie and Asfaw, 2015)
- ❑ Up to 99% Cr removal eff. (Terfie and Asfaw, 2015)

## ❑ Waste Management: Anaerobic Digestion



Credit: Renewable Energy Hub, UK

- ❑ Treats high strength waste - pretreatment
- ❑ Performs better with liquid wastes
- ❑ Good carbon and nutrients removal (up to 70% rem. eff.)
- ❑ High heavy metal conc. Inhibit anaerobes



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**NESREA: INSTITUTION AND STATUTORY MANDATE**

National Environmental Standards and Regulations Enforcement Agency (NESREA), a Parastatal of the Federal Ministry of Environment was established with an Act published in the Federal Republic of Nigeria Official Gazette No. 92. Vol. 94 of 31st July, 2007.

NESREA has responsibility to enforce all environmental laws, guidelines, policies, standards and regulations in Nigeria, as well as enforce compliance with the provisions of all international agreements, protocols, conventions and treaties on the environment to which Nigeria is a signatory.



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**NESREA STRATEGIES**

- Most environmental management strategies involve legal requirements and specific practices and procedures that directly or indirectly reduce or prevent pollution.
- These requirements are the first steps for environmental and public health protection and must be met by individuals and facilities that cause pollution.
- The second step is *compliance*—getting the regulated groups to fully implement the requirements. Without compliance, environmental requirements will not achieve the desired results.
- Compliance does not happen automatically but usually involves efforts to encourage and compel the behavioural changes needed to achieve it.
- The establishment of NESREA led to the development of Regulations to address these environmental problems.






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### REGULATORY PROVISIONS

- **National Environmental (Textile, Wearing Apparel, Leather And Footwear Industry) Regulations 2009**
- Main Thrust of the regulations Include:
  - a) an Environmental Impact Statement (EIS) for new industries and major developmental projects before commencement of operations;
  - b) an Environmental Audit Report (EAR) for existing industries every 3 years;
  - c) an Environmental Management Plan (EMP)
  - d) The installation of anti-pollution equipment ( Effluent Treatment plant)
  - e) The Polluter-Pays-Principle shall apply to every facility that pollutes. RE





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### REGULATORY PROVISIONS

- f) The collection, treatment, transportation and final disposal of wastes shall be the responsibility of the facility generating the wastes within the specified standards and guidelines.
- g) In the event of an incident resulting in an adverse impact on the environment whether socio-economically or health wise, the facility shall be responsible for:
  - the cost of damage assessment, control and clean-up;
  - remediation;
  - reclamation or restoration.
- h) Implementation of cleaner production processes and pollution prevention measures must be employed to yield economic, social and environmental benefits.


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### REGULATORY PROVISIONS



- (2) The collection, treatment, transportation and final disposal of wastes shall be the responsibility of the facility generating the wastes within the specified standards and guidelines.
- (3) In the event of an incident resulting in an adverse impact on the environment whether socio-economically or health wise, the facility shall be responsible for:
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  - c) reclamation or restoration.
- Implementation of cleaner production processes and pollution prevention measures must be employed to yield economic, social and environmental benefits.


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### SUSTAINABLE DEVELOPMENT

- ***"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs - World Commission on Environment and Development's (the Brundtland Commission) report **Our Common Future.**"***
- Goals of Sustainable Development

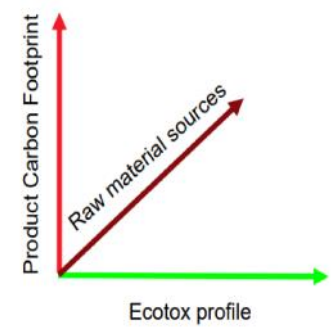



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## Hide traceability is an additional sustainability requirement in leather manufacturing

**3 main dimensions of environmental aspect of sustainability for leather**

- Ecotox profile – toxicity and safety of used chemicals to produce the material
- Product carbon footprint (PCF) – resource requirements of the product over its life cycle
- Renewable raw materials as a base for process chemicals and the origin of used substrates
- Hide traceability – ensurance of animal welfare and no further deforestation





Product Carbon Footprint

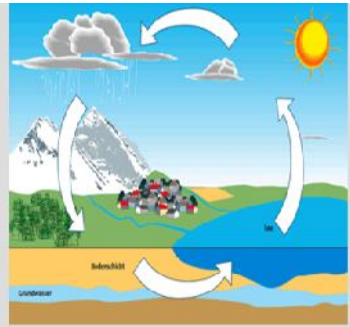

Raw material sources



Ecotox profile

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## Mega trends will positively affect the leather business and a demand for innovative, clean application technologies

Urbanisation		
Mobility		
Water	<ul style="list-style-type: none"> <li>▪ Water becomes the most pressured resource in liquids</li> <li>▪ In many areas of our planet it will be more important than oil</li> <li>▪ People will compete with animals for water</li> <li>▪ Water cleaning technologies and recycling systems are a "must"</li> </ul>	


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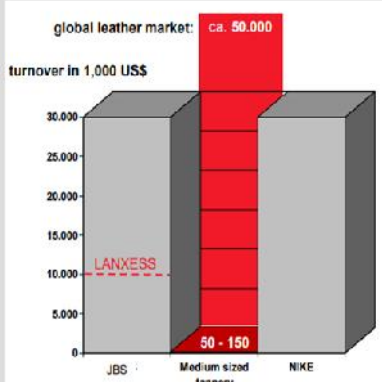
## The industry needs to orchestrate joined initiatives to maintain leather as a high valuable article

**A lot of things to do ...**

- We need to agree on standards for genuine leather and best available technologies
- We need to educate the end consumer and the sales people of leather consumer articles → LeatherNaturally!
- We need to do our homework developing new chemicals, improving the manufacturing process, and finding solutions for by-products



global leather market: ca. 50.000

turnover in 1,000 US\$



JBS :      Medium sized tannery      NIKE

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## There is still a wide spectrum of environmental efficiency in the leather industry in operation

**Best available technology (BAT) for leather manufacturing is key**


- Best practice standards are established, which ensure a sustainable leather manufacturing
- Metrics are defined in LWG protocol
- Today's BAT-production of 1m<sup>2</sup> leather requires 10 times less water than the production of a Blue jeans

1 m<sup>2</sup> leather:      ~ 110 l

1m<sup>2</sup> blue jeans fabric: ~ 1.500 l

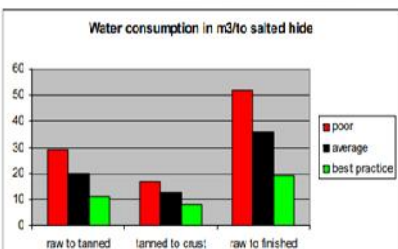
Waste management

Low water consumption/pollution      Low energy processes





Safe/harmless chemicals

Water consumption in m<sup>3</sup>/tc salted hide



Stage	poor	average	best practice
raw to tanned	~28	~18	~10
tanned to crust	~15	~10	~8
raw to finished	~50	~35	~18






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## Scientific based eco study could deliver the right facts to improve the image of leather


**Steps to develop a Life Cycle Assessment of Leather**

	Input	Process	Output
<ol style="list-style-type: none"> <li>1. Software tool to develop the Corporate Carbon Footprint (CCF) → done by FGL</li> <li>2. Development of a Product Carbon Footprint (PCF) of Leather (incl. chemicals and meat production)</li> <li>3. Cradle to gate LCA bench mark with alternative materials</li> <li>4. LCA cradle to grave bench mark incl. consumer product (e.g. shoe) production, use and after use</li> </ol>	<div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Energy</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Chemicals</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Water</div> <div style="border: 1px solid black; padding: 2px; margin-top: 5px;">Product Carbon Footprint</div>	<div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Farming Slaughter/Meat prod.</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Hide Preparation</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Tanning</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Retanning</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Finishing</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Cutting/Sawing</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Seat Manufacturing</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Use</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">End of Life</div>	<div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Corporate Carbon Footprint</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">CO<sub>2</sub></div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Solid waste</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Waste Water</div> <div style="border: 1px solid black; padding: 2px; margin-top: 5px;">Cradle to gate</div> <div style="border: 1px solid black; padding: 2px; margin-top: 5px;">Cradle to grave/cradle</div>




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- Brands have set restricted substances lists for crucial chemicals
- Brands have established an environmental auditing process for best practice leather manufacturing for their suppliers (→Leather Working Group)
- Brands are committed to a hide traceability back to ensure a sustainable origin (→ Hide Working Group)

- Brands are not ultimately interested in leather, they just need a high performance substrate to work with and want to ensure their environmentally clean philosophy







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**SLM is a comprehensive management approach to provide sustainability solutions to the leather industry**

**Article performance**

- Products that enhance the lifetime of the leather final good
- Light weight or low mass leather
- development of leather recycling systems or bio degradable leathers.





**New chemical systems**

- COD optimized and salt free retanning systems
- zero free formaldehyde and phenol
- VOC free finishing systems based on renewable resources.


**Process improvements**

- eco efficient beamhouse process,
- chrome tanning maximum Cr-exhaustion and zero Cr VI
- development of a sustainable wet white system
- Realize possible recycling option for by-products



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## Conclusions

- Tanning process has high water demand
- Dumped untreated tannery solid wastes contaminate soil and groundwater
- High strength wastewaters discharged into natural water bodies causes water pollution
- Liquid wastes contaminate and pollute freshwater
- Urgent and dire need for enforcement of regulations
- Need for sustainable methods in leather tanning
- All sector players should join hands with NESREA to Make Nigerian environment free of tannery waste
-



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# THANK YOU

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