Compliance and Beyond

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1. **Sustainability - Issues**
   Concerns and issues connected to be compliant
2. **Sustainability - Concept**
   Concept and pillars of comprehensive sustainability
3. **Sustainability Performance measurement**
   Tools / Codes
4. **Sustainability Measures for Leather Industry**
   Strategies and Technologies

Compliance - the issues

Concerns to be Compliant

- **Present system of end-of-pipe treatment, can not ensure meeting norms comprehensively**
- **Specifically, TDS norms can not be met sans resorting to recycling and reuse**
- **RO mediated Zero liquid discharge is not economically viable**

End-of-pipe Approach: Issues

- **Collective responsibility demands significant degree of discipline and ethics**
- **In-house responsibility not conspicuously seen**
- **Absence of internal regulatory mechanism for discharge**

TDS: Concerns

- **TDS (specifically inorganic TDS) can not be addressed through any end-of-pipe treatment**
- **Translocation of pollutants resorted to than termination of waste generation cycle**
- **Resources are wasted on one hand and treated further on the other, resulting in double expenditure**

RO Mediated ZLD: Concerns

- **Solids are not disintegrated but separated**
- **Energy intensive**
- **No viable solution for secured disposal of RO reject**

Compliance Aspects Unaddressed

- **Solid waste - Not addressed**
- **Odor - No initiatives taken**

Causes for Concerns

- **Resorted to end-of-pipe solutions at the outset**
- **Failure of collective responsibility (concept of CETP)**
- **‘Cost of non-compliance is significantly higher than cost of compliance’ - Not understood**
- **Inadequate long-term strategies**

To be Sustainably Compliant

- **Opting for In-process measures and cleaner technologies**
- **Installing measures for addressing the issues of solid wastes and odor**
- **Devising mechanism to regulate discharge internally**
- **To march BEYOND COMPLIANCE for attaining SUSTAINABILITY**

Not Much Known

‘Cost of non-compliance is higher than the cost of compliance and the cost of compliance is higher than the cost of sustainable’

Therefore, it is product and economically sound TO BE SUSTAINABLE than being non-compliant or just compliant.

Hence, Shall we look BEYOND COMLIANCE?

Beyond Compliance - The Concept of Sustainability

Sustainability

Development that meets the needs of the present without compromising the ability of the future generations to meet their own needs

Triple Bottom Line

People

Measuring human and societal implications towards higher quality of life

Planet

Mitigating impacts on the environment from factors such as energy, pollutants and emissions

Profit

Maximizing efficiency and reliability of systems to facilitate economic growth

Why Sustainability?

- **To provide essential human needs**
- **To fulfill agricultural requirements**
- **To manage climate change**
- **To secure financial stability**
- **To sustain biodiversity**

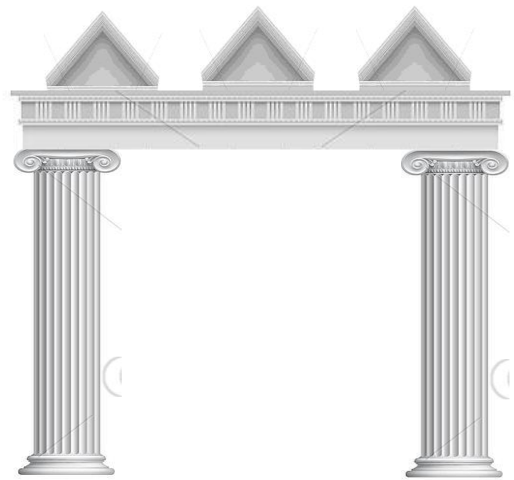
Sustainability Perfromance Measurement

Five Aspects

Economic Sustainability

Environmental Sustainability

Societal Sustainability



Organizational Governance

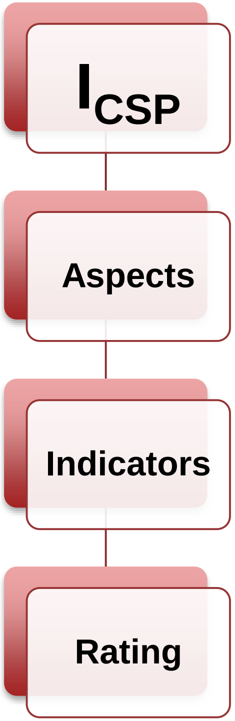
Technical Aspects

I_{CSP} - Why?

Comprehensive Sustainability Performance Index (I_{CSP})

- **An indicator of sustainability of an organization**
- **Helps to monitor the progress of sustainability**
- **Provides the framework for sustainability management**

I_{CSP} - How?



Environmental Sustainability - Indicatars

- **Wastewater Generation (L/Kg of starting material)**
- **BOD load (Kg of BOD/ton of starting material)**
- **COD load (Kg of COD/ton of starting material)**
- **TDS load (Kg of TDS/ton of starting material)**
- **Chloride load (Kg of Cl^{-}/ton of starting material)**
- **Chromium load (Kg of Cr/ton of starting material)**
- **Sulfide load (Kg of S^{2-}/ton of starting material)**

Environmental Sustainability - Indicatars

- **Treatability level (BOD/COD)**
- **Solid waste generation (Kg of process waste/ton)**
- **H_2S generation (Kg of H_2S/ton of starting material)**
- **Ammonia load (Kg of NH_3/ton of starting material)**
- **Sludge load (Kg of sludge/ton)**
- **Compliance to regulatory requirements (1 to 10)**

Technical Aspects - Indicatars

- **Atom economy rate (Kg of product/ton of starting material)**
- **Energy consumption (kWh/ton of starting material)**
- **Labor productivity ($/ton of starting material)**
- **Rejection rate (Kg of reject/Kg of starting material)**
- **Product development (No. of new products/annum)**
- **Customer satisfaction index (1 to 10)**

Economical Sustainability - Indicatars

- **Financial turnover ($/annum)**
- **Profit ratio (profit/capital employed)**
- **Profitability (profit/turnover)**
- **Liquidity ratio (liquid/total asset value)**
- **Operating margin (operating income/revenue)**

Social Sustainability - Indicatars

- **Fatality (No. of fatal accidents/annum)**
- **Accident rate (No. of accidents/annum)**
- **Absenteeism (No. of absent man-days/No. of total man-days)**
- **Employee training (No. of employees trained/annum)**
- **Peripheral development (amount spent/annum)**
- **Employee satisfaction index (1 to 10)**

Social Sustainability - Indicatars

- **Job generation (No. of new jobs/annum)**
- **Employee empowerment (1 to 10)**
- **Compliance to statutory social requirements (1 to 10)**
- **Well-being of local community (amount spent/annum)**

Methods for Indicaor Analysis

- **Equal Weight**
- **Factor Analysis**
- **Data Envelopment Analysis**
- **Unabsorbed Component Models**
- **Distance to targets**
- **Public opinion**
- **Analytic Hierarchy Process**
- **Conjoint Analysis**

Derving I_{CSP}

I_{S1} : Economic Sustainability Index

I_{S2} : Environmental Sustainability Index

I_{S3} : Societal Sustainability Index

I_{S4} : Organizational Governance Index

I_{S5} : Technical Aspect Index

Derving I_{CSP}

I_{S1} : Economic Sustainability Index

$I_{S1} = \Sigma\ [(W_n.R_{im})];$

where Wn is the weightage for respective indicator and R_{im} is rating w.r.t the respective indicator

Finally I_{S1} to I_{S5} will have values from 1 to 10

$I_{CSP} = (I_{S1}+I_{S2}+I_{S3}+I_{S4}+I_{S5})\ X\ 2$

Sustainability Measures for Leather Industry

Environmental Sustainability

Salinity (chloride level):

A. **Long-term measures:**
   - **Preservation by chilling**
   - **Green hide processing**

B. **Short-term measures**
   - **Electro-oxidation of soak liquor, and reuse of salt**
   - **Green formulation for preservation**
   - **Pickle-free process or waterless chrome tanning**

Environmental Sustainability

TDS:

- **Sulfide-free enzyme based process**
- **Reuse of liming and reliming wastewater**
- **Pickle-free process or waterless chrome tanning**
- **Use of syntans with low salt content**

Environmental Sustainability

Sulfide:

- **Sulfide-free enzyme based process**
- **Reuse of liming and reliming wastewater**

Environmental Sustainability

BOD, COD and BOD/COD:

- **Hair-saving unhairing**
- **Electro-oxidation and reuse of sectional streams**
- **Use of syntans that are not bio-refractories**

Environmental Sustainability

Chromium:

- **Waterless chrome tanning**
- **Direct Chrome Liquor Recycling**
- **Chromium recovery and reuse**

Environmental Sustainability

Process Solid wastes:

- **Reuse of recovered salt**
- **Conversion of raw trimmings into high-grade gelatin**
- **Manufacturing of compost or hydrolysate from hair**
- **Manufacture of activated carbon or collagen hydrolysate from fleshings**
- **Preparation of board from shavings**

Environmental Sustainability

Gaseous emissions:

- **Sulfide-free unhairing process**
- **Ammonia-free deliming**
- **Bio-filter**

Environmental Sustainability

Sludge:

- **Reuse of sectional streams**

Strategy - Wastewater

Soaking → 5 L/Kg Soak liquor → EO + Evaporation + Recovery and reuse of salt

↓

Enzyme assisted unhairing (paste/drum) → No wastewater

↓

Reliming → 2.5 L/Kg Soak liquor → Reuse for reliming

↓

Waterless Cr Tanning → No wastewater

Zero Wastewater Discharge could be achieved through in-process measures with no generation of sludge

Strategy - Wastewater

Neutralization → 3 L/Kg wastewater → EO + limited reuse for neutralization

↓

Wet-finishing → 1 L/Kg wastewater → EO + limited reuse for neutralization

Wastewater after limited reuse → Sand filter + C filter + SDB + SLF

Volume of sludge (to be disposed through SLF) reduced by 25 folds

Zero wastewater discharge could be achieved through in-process approach

Strategy - Solid Wastes

Raw trimmings → Gelatin

↓

Recovered salt → Reuse for preservation

Fleshings → Activated carbon / hydrolysate / syntan

Hair → Compost / hydrolysate / syntan

Strategy - Solid Wastes

Trimmings → Protein hydrolysate / syntan

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Buffing dust → Syntan

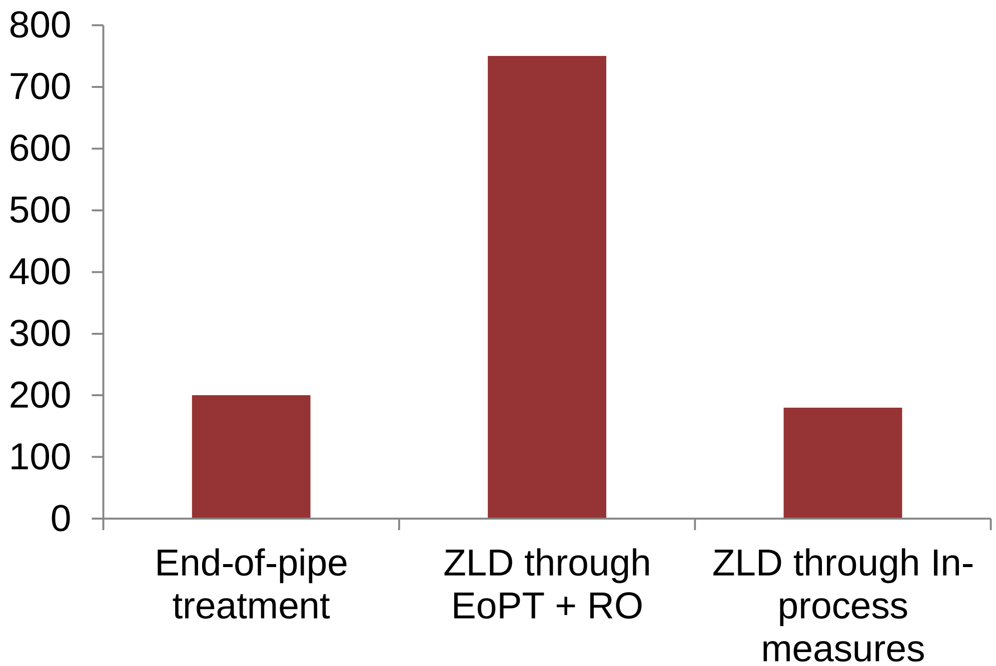
Solid wastes engender financial returns

Strategy - Gaseous Emissions

Minimization of H_2S through low-sulfide process

Ammonia and H_2S may be addressed using bio-filter

Cost



Cost of treatment in Rs./m^3 of wastewater


Thanks!