ZLD IN TEXTILE INDUSTRY

The textile industry is one of the oldest and largest industrial sectors in India and our country is the second largest producer of textile and garment next to China. The textile industry in India constitutes one of the country's major export sectors. India makes a major contribution to world trade in cotton yarn, accounting for some 25% of the total.

This sector contributes about 14% to India's industrial production, 4% to country's Gross Domestic Product (GDP), 27% to the country's foreign exchange inflows and 13% to the country's export earnings. The textile sector, the second largest provider of employment after agriculture; provides direct employment to over 45 million people.

Environmental issues of textile industries

The textile industry *is water and labor intensive* and produces pollutants of different forms. The manufacturing operation also generates vapors during dyeing, printing and curing of dye or color pigments. Dust emission is associated with fiber processing/boiler operation. Other than these process operations, textile mills have wood, coal or oil fired boilers and thermic fluid heaters which are point emission sources. Major environmental issues in textile industry result from wet processing. Wet processes may be carried out on yarn or fabric. The transformation of raw cotton to final usable form involves different stages.

The various important wet processes involved in the textile industry are as follows:

• **Sizing / Slashing:** This process involves sizing of yarn with starch or polyvinyl alcohol (PVA) or carboxyl methyl cellulose (CMC) to give necessary tensile strength and smoothness required for weaving. The water required for sizing varies from 0.5 to 8.2 litre / kg of yarn with an average of 4.35litre / kg.

• **Desizing:** The sizing components which are rendered water soluble during sizing are removed from the cloth to make it suitable for dyeing and further processing. This can be done either through acid (Sulphuric acid) or with enzymes. The required water at this stage varies from 2.5 to 21 L /Kg. with an average of 11.75 L/Kg.

• **Scouring / Kiering:** This process involves removal of natural impurities such as greases, waxes, fats and other impurities. The de-sized cloth is subjected to scouring. This can be done either through conventional method (kier boiling) or through modern techniques (continuous scour). Kiering liquor is an alkaline solution containing caustic soda, soda ash, sodium silicate and sodium peroxide with small amount of detergent. The water required for this process varies from 20 – 45 L/ Kg. with an average of 32.5 L/Kg.

• **Bleaching:** Bleaching removes the natural coloring material and rendering the cloth white. More often the bleaching agent used is alkaline hydrochloride or chlorine. For bleaching the good quality fiber, normally peroxide is used. The chemicals used in peroxide bleaching are sodium peroxide, caustic soda, sulphuric acid and certain soluble oils. The water and chemical requirement and the effluent generation normally vary based on the type of operation and the material (yarn / cloth) to be processed. Bleaching the yarn both through hypo-chloride and hydrogen peroxide methods require same quantity of water and it varies between 24 to 32 L/kg. In the cloth bleaching, the water requirement is much higher and it fluctuates between 40 - 48 L/kg.

• **Mercerizing:** The process of Mercerization provides luster, strength, dye affinity and abrasion resistance to fabrics. It is generally carried out for cotton fabrics only for easy dyeing. Mercerization can be carried out through cold 10 caustic soda solution followed by washing with water several times. The water required for this process varies from 17 to 32 L / kg, with an average of 24.5

• **Dyeing:** Dyeing is the most complex step in wet processing which provides attractive color for the product. Dyeing is carried out either at the fiber stage, or as yarn or as fabrics. For dyeing process, hundreds of dyes and auxiliary chemicals are used. In brief, the water requirement for dyeing purpose (include all types and shades) varies from 36 – 176 L/kg with an average of 106. The effluent generation during dyeing process fluctuates from 35 to 175 L/kg with an average of 105 L/kg.

The characteristics of the textile wastes after the various processes

Processes	pH	Total Suspended solids mg/L	BOD mg/L
Sizing / Slashing	7.0 – 9.5	8500 –22500	620 – 2500
Desizing	6 – 8	16000 –32000	1700 – 5200
Scouring / Kiering	10 –13	2200 –17400	100 – 2900
Bleaching	6	6500-22000	-
Mercerizing	12 -13	430 –2700	150 – 280
Dyeing	10.5 10	200	400 – 700

Polices regarding ZLD in textile processing in India:

In view of the indiscriminate use of the water, its insufficiency, its conservation and the issues related to the waste water disposal and the pollution of the natural streams/rivers; the government is intending to issue a notification under the E.P.A. 1986 for implementation of ZLD in textile units having its effluent discharge more than 25 m3 /day and also for all textile units in clusters irrespective of their waste water discharge. The draft notification is issued in this context by MOEF & CC. In Chennai the judiciary has directed the CETPs of the textiles to go for ZLD in 2009 and then to the textile units in 2011.

Since March 2015 when Central Pollution Control Board (CPCB) issued notifications to 9 State Pollution Control Boards of states along the Ganga basin, a series of notices have been sent to factories asking them to submit action plan for achieving ZLD or face severe penalties (including shut down). The ZLD mandate has helped increase the focus of the industry to Water which has traditionally been an underpriced resource.

Need and viability of ZLD in textile processing in different textile Clusters in India

The industries i.e. textiles in different parts of the our country have adopted the concept of ZLD strictly according to their requirements e.g. the units in Tirupur in Chennai have installed ZLD system in order to comply with the directions of the Hon'ble court.

In Rajasthan the industries opted for ZLD because of the directions from the court, scarcity of water, its requirement for conservation.

Challenges against ZLD

In his response to the draft notification by the Ministry of Environment, Forest and Climate Change, Textiles Secretary, S. K. Panda, has said the proposed standards — mandating 'Zero Liquid Discharge' (ZLD) for textile processing units where waste water discharge is over 25 kilo liters a day — will be "too stringent" for the domestic textile processing industry that is largely unorganized and comprising of SMEs, according to reliable sources.

• Power usage due to the implementation of ZLD has shot up as a result of the treatment plants — 50 per cent of power used by industry goes into these plants alone. As a result, the industry as a whole has become less competitive due to a forced additional 4 per cent hike in the final garment price, which is a huge loss to the consumers.

• ZLD results in generation of the huge amount of hazardous solid wastes (particularly waste mixed salt) causing disposal challenges, which is being stored in storage yards within the CETPs. ZLD is generating thousands of tons of sludge as solid waste. This sludge has to be disposed of in a Secured Land Fill (SLF). The un-recovered Common Salt or Glauber's salt and the contaminants are sent to solar evaporation ponds for natural evaporation or sent to final Forced Circulation Multiple Evaporators for converting into Solid Waste. If we assume that all the dyeing factories totally use about 600 tons of salt daily, then the rejected salt will be about 100-150 tons every day. Imagine this for a whole year and for several years. We do not know what we are going to do with this future. It is a sleeping monster. In future this solid waste management will be another tough task. May be we will have to use incineration to burn them with modern machinery fitted air pollution control equipment. Still we may end up with salt.

• The major challenges faced were related to corrosion of metal, scaling and choking in tubes and necessity of skilled manpower to operate the plant.

• For the chemical sludge, the best way to dispose it off is its gainful utilization for cement co-processing but it needs tie up with a willing/recipient cement company

• The recovery of water and salt (Sodium sulphate and brine) offsets these costs significantly, but it would apply only to water scarce areas where the cost of water is high.

• High Carbon foot print of a ZLD facility is another major concern. The typical power consumption ranges from 8 to 10 kW/m3. The thermal evaporators alone consume about 20-40 Kw/m3 in addition to several tons of firewood for the boilers.

• Implementation of ZLD requires a host of advanced wastewater treatment technologies. Implementation of ZLD in Tamilnadu has highlighted several Technology shortcomings such as in Thermal evaporation & brine concentration, Salt separation and Crystallization, Color removal etc.

• ZLD requires use of higher amount of chemicals in wastewater treatment • ZLD Increases the energy usage tremendously.

• Impact on cost of processing (implementing ZLD pushes up costs of production by 25-30%)

• ZLD is an 'end-of-pipe' concept to mitigate the impact of wastewater pollution on the environment and human health • ZLD has very High CAPEX.

• It will be necessary to stop production if there is a breakdown in the Zero Discharge Plant which is a great loss.

• The ultrafiltration is a requisite before RO to minimize the damage to RO membrane which increases the cost of initial investment as well as the cost of treatment drastically

• Maintenance and operation cost of RO (ZLD) is very high

• The problems of Corrosion/leakages are encountered while using ms pipes which is required to be replaced by HDPE pipe which increases the cost and more so in the case of ZLD.

• The use of PAC to reduce the color content of the effluent requires the handling of powdered carbon leading to the issues of carbon dust emission (air pollution) in the plant

• MEE operation consumes more power and (thus more carbon footprint).It also generates salts which create problems of handling and disposal

• The entire ZLD system is highly sophisticated and needs skilled and experienced man power for its efficient operation which again increases the overall cost of treatment, operation as well as maintenance.

• The Zero Liquid Effluent Discharge is a very tough task. The plant must be designed very lavishly. All the tanks, pipe-lines, pumps, equipment, machinery, RO membranes, Multiple Evaporators should be designed for at least 20 – 30 % more than the requirement. During back washing, sand filters, carbon filters & Ultra Filtration generates contaminated wash water of about 20% of effluent feed. This is sent back to effluent collection tank and hence the plant needs higher design capacity by 20 – 30 %. Automation & Instrumentation is a must to safeguard the plant. A good laboratory is a must. All the critical equipment must have stand by ones.

• Biological plant needs continuous monitoring. Any mistake may stop the entire plant for several days. RO Plant needs maximum protection. Any small mistake will easily damage all the Membranes and it will cost several Lakhs of Rupees. Multiple Evaporators will easily get scaling & choking. For this it will be necessary to select a combination with costly Forced 18 Circulation Multiple Evaporators instead of simple Falling Film Multiple Evaporators.

• Most of the textile units in India are small scale & medium scale with land area below 10000 sq. yard. Putting up new ZLD compatible plant will require as much more land which is very costly & not available with the industries into their premises or in the adjoining area so the commercial viability will not be there.

• A ZLD plant is combination of RO & evaporator, a typical process house would be consuming 200 to 1500 m3 water daily, to treat such quantum of water & evaporate the same will require huge amount of electricity ranging from 3000 to 15000 kW per day. To produce such amount of electricity lot of fossil fuel, natural gas or enriched uranium is required and subsequently to control water pollution we will contribute equally for air pollution.

• The cost of ZLD will escalate to such level that production will not be globally competitive and it will add more troubles to the already depleted export market of the Textile sector.

• The figure for consumption of the water in Textile sector in the country is just @ 2% of the total water consumption.

• The cost of ZLD plant was estimated as follows Capital cost - Rs.18 crores per MLD + Land cost (varies in different Areas) + Cost of disposal of solid waste Land - 1.5 acre per MLD + the cost of finance Operating Cost - Rs.225 per m3 + Depreciation

• 90-95 % water can be recovered from the effluent, but cost of fresh water varies from area to area. For e.g. in UP it is free, Ichalkaranji it is Rs 17/m3 whereas in Tirupur it is Rs 75/m3.

Cost is high but not as significant as compliance

As far as operating cost is concerned, there are new technologies coming up which will reduce the cost of operation in ZLD. **Mr. V. D. Babu, Region Manager** – South Asia, Systems & Projects – Industrial at GE Water & Process Technologies said " There are recent technologies developed in American market, which will come here soon and the oxygen transfer will be 4 times higher which will reduce the energy usage in biological treatment. Similarly about the RO, new technology is coming up which will reduce the consumption of energy by 30 to 40%"

Although currently the industry is looking at it as a challenge and a sunk cost, in long term ZLD has the potential to provide tangible as well as intangible benefits to the companies. Take example of Arvind, they are experimenting with ZLD since 1998 they have always seen ZLD as a resource. **Mr. Sandeep Patel, Head – Environment, Arvind** said; "When we talk about scarcity of water, degrading quality of river streams our only sources of potable water, then we see ZLD as a resource rather than waste."

SMS Envocare is successfully operating a ZLD unit in Amravati (Maharashtra)Textile Park since 2016.

Source: https://www.ceeindia.org/ZLD%20Concept%20note.pdf

http://www.sustainabilityoutlook.in/content/market-outlook-zero-liquid-discharge-zld-indian-industry-755285