"REPORT ON ASSESSMENT OF POLLUTION FROM TEXTILE DYEING UNITS IN TIRUPUR, TAMIL NADU AND MEASURES TAKEN TO ACHIEVE ZERO LIQUID DISCHARGE"

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Chapter 1.0
Introduction

1.1 Background

Tirupur has 760 textile dyeing units established out of which 430 units are in operation. The untreated effluent was discharged into the Noyyal River till 1997. After the issuance of directions by Tamil Nadu Pollution Control Board (TNPCB) in 1997, these units have installed Common Effluent Treatment Plants (CETPs) consisting of physical, chemical and biological treatment units. Some of the units have installed individual ETPs (IETPs). The treated effluent was finally discharged into the river. The dyeing units use sodium chloride /Sodium sulphate salt in the dyeing process for efficient fixing of dyes on the fabric efficiently. This contributes high total dissolved solids (TDS) and chlorides in the effluent. CETPs and IETPs failed to meet discharge standards of TDS and chlorides and thereby significantly affected the river water quality. TDS level in the river water was in the range of 900 - 6600 mg/L and chloride was in the range of 230 - 2700 mg/l.

Orathupalayam dam is located across Noyyal river at 32 kms downstream of Tirupur. The pollutants carried by the river was accumulated in the dam. TDS in the dam water was in the range of 4250 - 7900 mg/L and chloride was in the range of 1600 - 2700 mg/L. The dam sediments contain heavy metals of chromium, copper, zinc and lead. In 2006, the High Court has directed the dyeing units to install zero liquid discharge (ZLD) plants and to stop discharging of effluent into the river. Accordingly, the industries have installed and commissioned the ZLD plants consisting of RO plant and reject management system in 2010.

The effluent after secondary treatment from the CETP is further treated in RO plant. The RO permeate is reused by the member units. The RO reject is concentrated in Multiple Effect Evaporator (MEE)/ Mechanical Vacuum Re-compressor (MVR). The concentrate is crystallized and centrifuged to recover salt. The salt recovered is reused. The liquid separated from the centrifuge is sent to solar evaporation pan. The salt collected in the solar pans is bagged and stored in secure land fill facility. Thus, the discharge into the river is now stopped. However, the damage caused to the groundwater and soil contamination in the river basin is yet to be restored.

To assess the measures taken by the Textile Dyeing units in Tirupur, the detailed studies in selected industries was taken to carry out performance evaluation of various pollution control system provided by the industries. The study also focuses on status of surface & ground water quality in the surrounding area.

1.2 Objectives and Scope of the Study:

The broad objective is to assess the pollution control measures taken by the Textile Dyeing units to achieve zero liquid discharge. The other specific study objectives are:

- Conducting baseline survey on type of process practised, water consumption, management of process solutions, treatment technologies provided, and management of hazardous wastes generated.
- Identification of major area of concern in the context of environmental management.
- Performance evaluation of treatment system by collecting samples.
- Assessment of status of surface and ground water quality in the surrounding area.
- Evaluation of compliance to the existing environmental regulations and norms.
- Providing valuable inputs for formulation of environmental management guideline.

1.3 Phases of Work

The project is planned to carry out in two phases in 18 months. The details of the study for Phase I and Phase II are as follow:

Phase **I:** Questionnaire survey in textile dyeing units and CETPs in Tirupur and followed by in-depth monitoring in 6 Common Effluent Treatment Plant and 3 Individual Effluent Treatment Plants.

Phase **II:** In-depth monitoring of 3 CETP's and 3 IETPS to cover different combination of ZLD system and assessment of Ground water & surface water quality along the Noyyal river and in the surrounding area.

1.4 Methodology

The list of CETPs and IETPs located in Tirupur were obtained through Tamil Nadu State Pollution Control Board. Separate questionnaire format were sent to CETPs and IETPs to obtain preliminary information. Based on the preliminary information provided and in consultation with TNPCB officers, 9 CETP' s and 6 IETPs were selected for field visit in Tirupur for detailed monitoring of pollution control measures taken by the units and also monitored surface water quality in Noyyal river and ground water quality in the surrounding area.

The phases of work involved are as follows:

1.5 Questionnaire Design

A comprehensive questionnaire is designed to collect information from CETPs and IETPs. The designed questionnaire to obtain first-hand information is enclosed at **Annexure - 1**.

1.6 Questionnaire Survey

The Questionnaire were sent to CETPs and IETPs to obtain preliminary information about the units. The information received from the units were compiled with respect to type of salt used in dying process, chemical used ,water consumption, wastewater generation and type of treatment system to achieve ZLD for selection of representative units for in-depth study.

1.7 In Depth Study

After obtaining the information through questionnaire, based on the type of salts used, type of ZLD system and recovery and recycle of salts generated through ZLD system, CETPs and IETPs were selected for in-depth monitoring. In-depth monitoring were carried out in presence of TNPCB officers and industry representatives.

Chapter 2.0
Textile Dying units at Tirupur – An Overview

2.1 Textile Dying Units in Tirupur

The textile plants are classified as one of the most polluting industrial sectors due to enormous quantity of wastewater generation and it's characteristic. Tirupur has 760 textile dyeing units established out of which 430 units are in operation. Partially treated and untreated effluent from dyeing units was discharged into the Noyyal River till 2006, which resulted in significant increase in TDS and chloride level in the Noyyal River and Orathupalayam dam located across the river. In 2006, the High Court has directed the dyeing units to install zero liquid discharge (ZLD) plant and to stop discharging of effluent into the river. Since majority of the units were small scale in nature, a few units clustered together to installed common effluent treatment plants consisting of physico - chemical, biological treatment, RO plant and reject management system to achieve ZLD. Presently, 20 CETPS and 66 IETPS are catering for treatment of effluent from textile dyeing & bleaching units present in Tirupur.

2.2 Textile Dying Process

The textile industry involves the spinning of a wide range of natural and synthetic fibers into yarn and the production of fabric from yarn. Spun yarns and fabrics may receive various treatments to improve their appearance. The raw materials used in textile works include natural and synthetic fibers. The raw materials used are;

Natural Fibers:	Semi-Synthetic:	Synthetic Fibers:
• Cotton	Rayon	Derivatives of oil
• Jute		
• Flax		
• Wool		
• Silk		

2.2.1 Production of Yarn and Fabric:

Picking, Carding and Combing of fibers are carried out to remove vegetable or other impure matter before the fibers are spun into yarn.

Carding and spinning:

Carding is the tearing of fibers using a series of machines with fine-pointed wire belts wound around large drums. The loose rope produced by carding is called card silver. Spinning is the drawing and twisting of card silver to make yarn. After spinning, the yarn may be sent for dyeing before it is used to weave or knit a fabric.

Weaving:

Weaving uses traditional flying shuttle looms to form the fabric from the yarn, but sometimes special features like water jet systems or air pulsing to increase the output of woven fabric.

Knitting:

Knitted fabrics are made by the intermeshing of one or more yarns to form loops and in order to form the loops, the yarn must be bent in a number of directions. Knitting may be used to form garment sized pieces or whole garments. Residual oils present in wool fibers or fabrics and sizing agents (usually applied to cotton yarns) improve workability during knitting or weaving.

2.2.2 Treatments to fibers, yarns and fabric:

Mechanical and chemical processes may be applied to improve the workability or finish of fibers, yarn and fabric. Treatments which involve chemical addition usually involve bath immersion or padding (roller coating). Many of the chemicals used are potential contaminants. Fabrics may be treated with compounds to prevent fungal or mould growth.

Bleaching:

Bleaching is accomplished by oxidation or reduction. Cotton and other cellulosic fibres are treated with alkaline hydrogen peroxide. Sodium hypochlorite was used in the past but is now generally only used to bleach linen. Wool and other animal fibres are subjected to

acidic reducing agents. Synthetic fibres can be treated by either oxidation or reduction, depending upon their chemical composition. The treatment can be under taken by immersion under pressure and high temperature followed by rinsing and drying.

Drying:

Excess water is removed mechanically by centrifuge squeezing and vaccum suction rolls. Remaining moisture is removed by passing the fabric or yarn through heated dryers under controlled temperature, humidity, drying time, dimensional stability.

Mercerisation:

This process is applied to cotton and cotton blends to increase lustre and to improve strength and affinity for dyes. The treatment produces a swelling of the fibre, it can be applied at yarn or fabric stage and involves immersion of the material in a sodium hydroxide solution followed by cold spraying and then neutralisation with acid or by liquid ammonia treatment.

Sizing and desizing:

Sizing chemicals are applied to wrap yarns(especially cottons) to enable them to withstand the stresses of weaving. Sizing chemicals include polyvinyl acetate(PVA). Polyacrylic acid and carboxymethyl cellulose. These chemicals are removed by desizing, often achieved by applying solutions of enzymes such as malt diastase.

2.2.3 Dyeing process

Dyeing is the process of adding colour to textile products like fibers, yarns, and fabrics. Dyeing is normally done in a special solution containing dyes and particular chemical material. After dyeing, dye molecules have uncut chemical bond with fiber molecules. The temperature and time controlling are two key factors in dyeing. There are mainly two classes of dye, natural and man-made. The primary source of dye, historically, has generally been nature, with the dyes being extracted from animals or plants. Artificial dyes have been produced to achieve a broader range of colors and to render the dyes more stable to resist washing and general use. Different classes of dyes are used for different types of fiber and at different stages of the textile production process, from loose fibers through yarn and cloth to completed garments.

Acrylic fibers are dyed with basic dyes, while nylon and protein fibers such as wool and silk are dyed with acid dyes and polyester yarn is dyed with disperse dyes. Cotton is dyed with a range of dye types, including vat dyes, and modern synthetic reactive and direct dyes.

2.2.4 Dyes

Dyes are colourless soluble in a carrier, mostly water or an organic solvent. Classification of dyes according to method of application is shown below, together with types of textile fibre that can be commercially dyed by each method:

- Basic--Cationic dyes (wool,wool blends, silks, acrylic)
- Acid--anionic dyes (wool, silk and nylon)
- Direct--anionic dyes (cotton, linen, viscose)
- Chrome--anionic dyes that must be applied with sodium dichromate(wool)
- Azoic--Insoluble pigments formed within (cotton,linen) the fibre initially by a soluble coupling compound and then a diazotized base
- Vat and sulphur--Insoluble in water and converted into soluble colourless compound by use of sodium hydrosulphite. Ex: cotton, viscose, linen, silk.
- Disperse--non ionic dyes such as polyester, triacetate, secondary acetate
- Metal complex--anionic dye containing chromium ex: wool,nylon.

2.2.5 Bleaching

Bleaching is one of the stages in the manufacture of textiles. All raw textile materials, when they are in natural form will have its natural color, odor and impurities that are not suitable for clothing materials. Not only the natural impurities will remain on the material but also the add-ons that were made during its cultivation, growth and manufacture in the form of pesticides, fungicides, worm killers, sizes, lubricants, etc. The removal of these natural coloring matters and add-ons during the previous state of manufacturing is called scouring and bleaching.

2..3 Water Consumption

In most of the textile dyeing units the water consumption is around 140-200 l/d for producing 1 kg of fabric material.

2.4 Sources of Wastewater

Textile industry being a wet fabric processing industry includes, de-sizing, scouring, bleaching, mercerizing, dying, printing and finishing stages. During each stage different type of chemicals are used such as strong acids, strong alkalis, inorganic chlorinated compounds, hypochlorite of sodium, organic compound such as dyestuff, bleaching agent, finishing chemicals, starch, thickening agent, surface active chemicals, wetting and dispersing agents and salts of metals. Various dyes are used during dying stage for coloring purpose; multicolor are used to improve beauty of products. The main products of textile industries in Tirpur are raw cotton based like pullout, towels, napkins and power looms. The processing steps involved and pollutants generated are shown in below schematic figure

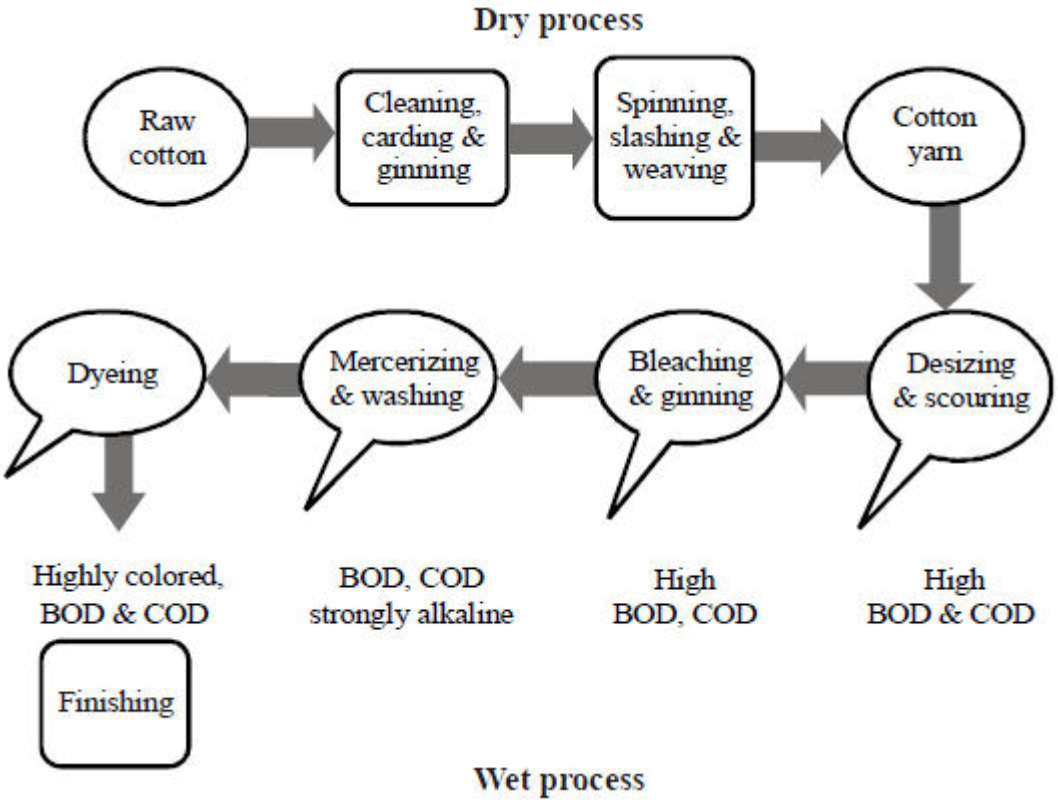


Figure 1: Cotton fabric production and associated water pollutants

2.4.1 Wastewater generation and Nature

Table 2: Wastewater generation processes and their nature

Process	Nature
Sizing	High in BOD, COD
De-sizing	High in BOD, COD, Dissolved Solids

Bleaching	High alkalinity, Suspended Solids
Mercerizing	High P^H, Dissolved Solids
Dyeing	Strong Color, High BOD, Dissolved Solids
Printing	Color, High BOD, Suspended Solids

2.5 Pollution Potential in Textile dying units

The textile industry consumes a substantial amount of water in its manufacturing processes used mainly in the dyeing and finishing operations. Considering the volume generated as well as the effluent composition, textile plants is classified as one of the most polluting industrial sectors. Textile wastewaters are characterized by extreme fluctuations in parameters such as chemical oxygen demand (COD), biochemical oxygen demand (BOD), pH, color and salinity. The composition of the wastewater depends on the different organic-based compounds, chemicals and dyes used in the dry and wet-processing. During dyeing process it has been estimated that the losses of un-fixed dyes to the environment can reach 10–50%. One of the most difficult tasks confronted by the wastewater treatment plants of textile industries is the removal of the color, mainly because dyes and pigments are designed to resist biodegradation, such that they remain in the environment for a long period of time.

In addition, tremendous quantity of unused salts such as sodium sulphate and sodium chloride reaches the effluent stream increasing the TDS level. Presence of sulphur, naphthol, vat dyes, chromium compounds and heavy metals and certain auxiliary chemicals all collectively make the effluent highly toxic. Other harmful chemicals present in the effluent may be formaldehyde based dye fixing agents, hydro carbon based softeners and nonbiodegradable dyeing chemicals. The mill effluent is often of a high temperature and pH. The colloidal matter present along with colors and oily scum increases the turbidity and imparts foul odour to the effluent.

2.6 Treatment system Installed to achieve Zero Liquid Discharge

The Textile dyeing units in Tirupur have physico - chemical, biological treatment followed by Reverse Osmosis for water recovery; and Multiple Vapor Re-compressor and Multiple Effect Evaporator for salt or brine recovery through CETPs or IETPs to achieve Zero Liquid Discharge. The concept of Common Effluent Treatment Plant was originated to

treat the wastewater generated by cluster of small scale industries since such units are not in a position to have individual treatment facilities due to space constraints, high capital/maintenance cost, etc. Since most of the textile dyeing units are small scale, CETPs are ideal option for effluent treatment. Thus, most of the textile dyeing clusters in India has established and commissioned several CETPs. The overall treatment process technology implemented in CETPs and IETPs to treat textile industry effluent is same while the scale varies.

The raw effluents generated by various sections of textile process are collected in a storage tank inside the factory premises of the individual member unit. The effluent is collected by gravity through HDPE pipes to a collection well from where it is pumped to the respective CETPs. At the CETPs, the effluent is first passed through screen chamber to remove floating material and stored in equalization tank for homogenization of effluent received from different units before subjecting to the main treatment processes such as physico - chemical treatment and biological treatment. In biological treatment, the physico chemically treated effluent is fed into aeration tank of different aeration techniques to convert bio- degradable organic components into bio-mass. The effluent with biomass being taken to clarifier where the bio-mass settle by gravity and clear supernatant overflows into a sump. The excess sludge is removed into a sludge thickener. The clear supernatant water from clarifier is subjected to quartz filtration for removal of suspended solids; resin filtration for color removal; softening to reduce calcium and magnesium hardness; and chlorination to prevent growth of microorganisms as well as for colour removal.

A few CETPs have installed Oxidation -Reduction reactor. The reactor has HDPE pipes of suitable diameter and length arranged in parallel arrays and interconnected, where acidification, injection of activator chemicals into reactor and pH correction of effluent takes place. The O-R treated effluent is taken to flash mixer for addition of coagulating agent and then sent to flocculator and tube settler for settling of micro suspensions to yield a treated effluent free of the fragmented dyestuff and original COD causing dyestuff. After settlement, the effluent is passed through dual media filters for retention of fine solids and ultrafiltration for removal of micron sized suspensions and colloids and then treated through activated carbon filters before feeding into the RO system. The RO permeate recovered is distributed to member units through dedicated pipeline from CETPs.

The RO rejects is further treated through combination of Mechanical Vapour Recompression (MVR) Evaporators, Multi Effect Evaporator (falling film/forced circulation) crystallizers and centrifuges for recovery and reuse of salt (brine solution). The concentrated effluent is fed into a crystallizer to enhance the formation of salt crystals and the condensate is collected and reused along with RO permeate. The concentrates with crystals from crystallizer are taken into a centrifuge for salt separation. The separated salts and salt solution (MEE concentrate) are reused by the member units and a portion of the mother liquor is taken to solar evaporation pond to recover mixed salt. The biological and chemical sludge is dewatered in filter press and disposed in secured landfill or through authorized agencies.

Chapter 3.0
Questionnaire Survey and In-Depth Study

3.1 Preliminary data obtained through Questionnaire

This office has prepared questionnaire to obtain preliminary information about the CETPs and IETPs. 5 CETPs out of 20 CEPTs, and 2 IETPs out of 66 IETPs have provided the information. Detailed field investigations were conducted in 6 CETPs & 3 IETPs in 1st phase and 3 CETPs & 3 IETPs after obtaining preliminary data from the CETPs and IETPs. The Compiled information of CETPs and IETPs which are submitted the filled questionnaires are given in **Annexure 2**.

3.2 Study carried out at Tirupur

Tirupur, the "knitwear capital" of India, is a city corporation located at 11.1075°N 77.3398°E, 47 km east of Coimbatore in the Indian state of Tamil Nadu. The town is renowned as India's leading cotton knitwear center, accounting for over 90 % of the country's exports in this sector. The textile industry provides employment to over six lakh people and has an annual turnover of 220 billion Rupees. There are nearly about 3000 sewing units and 1326 knitting units, and other ancillary units. Some of the world's largest retailers including C & A, Switcher SA, Walmart, Primark, Lauren diesel, Tommy Hilfiger, Fila, Reebok import textiles and clothing from Tirpur.

Tirupur has 760 textile dyeing units established out of which 430 units are in operation. Presently, 20 CETPs and 66 IETPs are catering for treatment of effluent from textile dyeing units present in Tirupur.

3.3 General Observations made during field study of CETPs and IETPs at Tirupur industrial Area:

i. Around 17 CETP's are operating at 30-40% of installed capacity and 3 CETP's are operating at 70% of installed capacity as per the directions of TNPCB.

ii. All CETPs/IETPs are having treatment facilities comprising of Physico chemical followed by biological and advanced treatment viz Nano/RO followed by MVRE/MEE and salt recovery system.

iii. All CETPs and IETPs are having online flow measurement system to quantify the effluent received from the individual unit, quantity of effluent treated and quantity of treated effluent sent to their member units for reuse in their process and same is connected to TNPCB network system.

iv. The CETPs/IETPs are unable to recover 100% salt from the RO reject, still 5-31% of RO reject is disposed in solar evaporation ponds.

v. Some of the CETP's are sending partially concentrated brine to their member units through tanker and some of CETP's are recovering the pure salt after concentrations.

vi. Pure salt recovered from the RO reject is being utilised in the process and impure salt recovered is stored under shed.

vii. All CETPs and IETPs are storing huge quantity of chemical sludge generated from ETPs.

viii. Utilisation of chemical sludge in cement industry as auxiliary raw material is to be speeded up by TNPCB, based on the trail run.

ix. All CETPs and IETPs are looking for scientific disposal options for impure salt and exploration of utilisation of impure salt in other industrial sector as auxiliary raw material.

3.4 Details of CETPs and IETPs studied

3.4.1 M/s Andipalayam Common Effluent Treatment Plant (P) Limited

General Information:

Address of the CETP	:	M/s Andipalayam Common Effluent Treatment Plant P)Limited., Mangalam Road, Anaipalayam, Tamil Nadu
Installed capacity in MLD/KLD	:	4.5 MLd or 4500 KLd
Operating capacity in MLD	:	1.35 MLD or 1350 KLD
Number of member units	:	20
Sequences of treatment system exist to achieve ZLD	:	Receiving tank, equalization and neutralization tank, Aeration tank, secondary clarifier, oxidation reduction process, OR sump, flash mixer, tube

		settler, dual media filter, ultra filtration, Activated carbon filter, Reverse osmosis followed by nano-filteration, MVR, MEE and solar evaporation pond
Quantity of treated effluent recycled to member units	:	1080 KLD
Type and Quantity of salt recovered per day	:	Sodium chloride 108 kld as liquid brine
Quantity of salt recycled into member units	:	Sodium chloride 108 kld as liquid brine
Quantity of concentrated effluent sent to solar evaporation pond	:	2 kld
Quantity of impure salt generated per day	:	Approx. 1.7 tons/day
Quantity of impure salt accumulated in storage shed	:	2000 tons

Specific Observation of the units :

(i) M/s Andipalayam Common Effluent Treatment Plant (P) Limited, has 20 member units, out of which 8 member units are actively operating.

(ii) The CETP was operating at 30 % of installed capacity since 2012.

(iii) The effluent being received through pipeline. All member units are using sodium chloride salt in the process.

(iv) The trade effluents are received in receiving tank through closed conduit by gravity. The pH of the raw effluent is around 9.2 and hence HCl is added in neutralization tank to neutralize the effluent. Neutralized effluent is being sent to aeration tank of 3MLD capacity provided with diffused aeration system and maintained 3000 mg/l of MLSS. Overflow of aeration tank is taken to secondary clarifier where 85 % of COD and 60% of TSS are reduced through separating bio mass. Supernatant of secondary clarifier is being treated in Oxidation Reduction Reactor (ORR) of 8.5 lakh liter capacity where chlorine gas is feed at the rate of 50 ppm with residential time of 1 hr to disinfect and to remove colour.

(v) Treated effluent from ORR is stored in OR sump and sodium metabisulphate is added to remove residual chlorine. Lime (400-500 ppm) and poly aluminum chloride (0.2 ppm) are added in the flash mixer and effluent is passed to tube settlers. Sludge from primary and secondary clarifier and tube settlers are dewatered in filter press.

(vi) HCl dose is provided to the effluent at the outlet of the tube settler. Treated effluent is collected and feed to Dual Media Filter (DMF) followed by ultra-filter of capacity 225 m^3/hr with 2 skids followed by activated carbon filter. The unit has 2 stage RO systems with each having 2 skids, with each skid of capacity 112.5 m^3/hr. Pretreated effluent is being treated through RO. The RO permeate being sent to the member units along with condensate water. RO reject is being treated through nano filter. Nano filter permeate known as brine is supplied to member units after lime treatment at the dose of 300 ppm. Reject from nano filter is passed to MVR followed by MEE. The unit has 2 stages MEE with falling film type and forced circulation type. After concentration through MVR followed by MEE with falling film, the concentrated brine of 108 kld being sent to their member units and remaining is further concentrated through MEE with forced circulation, the final concentrated effluent in the tune of 2 kld being sent to solar evaporation to recover impure salt through natural evaporation. It is informed that the steam fed in the tune of 664 kg/hr to the MEE.

Collection Tank

Chemical sludge dewatered in filter press

Solar Evaporation Pond

Mixed salt from Solar evaporation pond

(vii) It is informed that around 2000 tons of mixed salt is being generated since inception of ZLD and same being stored in the CETP premises.

(vii) It is informed that around 3000 tons of ETP sludge was sent to M/s Ultratech Cement, Ariyalur (at the cost of Rs. 1300/ton) for co processing.

(ix) It is informed that co -member units are charged an average of Rs. 180 /kl. CETP operation maintenance cost is worked about Rs. 150/kl.

(x) During inspection samples being collected at various points of CETP to verify the efficiency of ZLD system, the analysis results are depicted below:

Location of samples collected / **Parameters**	**Equalization Tank**	**Secondary treated (Tube Settler out let)**	**RO feed**	**RO permeate**	**RO reject**	**Nano brine**	**Nano reject**
pH	9.3	6.7	6.8	6.8	6.6	7.5	7.1
TSS (mg/L)	860	1604	- _	- ___	32	20516	68
TDS (mg/L)	8374	9210	9454	400	42244	20406	44234
BOD (mg/L)	307	10	___	___	___	___	___
COD (mg/L)	535	299	___	___	___	___	___
Chloride (mg/L)	3589	4977	4475	96	22828	12730	12395
Sulphate (mg/L)	536	675	___	___	___	___	___

Location of samples collected / **Parameters**	**MVR Concentrate**	**MVR condensate**	**MEE Concentrate**	**MEE condensate**
pH	7.5	7.0	7.4	7.2
TSS (mg/L)	2950	----	106130	-----
TDS (mg/L)	56242	426	171580	172
Chloride (mg/L)	31966	191	60088	12
MLSS concentration in Aeration Tank (mg/L)			2945	

(xi) From the analysis results RO efficiency is worked about 77.6 %, based on flow meter reading taken during the inspection RO efficiency was found 78%. As per analysis results the solid concentration is increased from 4.4 to 5.9% through MVR and further it was increased upto 27.7% through MEE. As per the analysis results the MEE final concentrate which is being sent to solar evaporation is worked about 15 kld. Based on

flow reading taken at different points of MVR and MEE during the inspection also confirms the same, the quantity of concentrated effluent sent to solar evaporation pond worked about 16 kld. However CETP claims that only 2 kld of effluent being sent to solar evaporation and the same is not matching with field observation and the quantity of concentrate sent to solar evaporation was found in higher side.

3.4.2 M/s Rayapuram Common Effluent Treatment Plant (P) Limited

General Information:

Address of the CETP	:	Rayapuram Common Effluent Treatment Plant (P)Limited_ S.F.No.642, Anaipalayam Sirupooluvapatti (PO) Tirupur-641 687
Installed capacity in MLD/KLD	:	5.5 MLD or 5500 KLd
Operating capacity in MLD	:	1.3 MLD or 1300 KLD
Number of member units	:	25
Sequences of treatment system exist to achieve ZLD	:	Receiving tank, homogenization tank, Biological oxidation tank, clarifier, quartz filter, resin filter, BDTRF, softener filter, Reverse osmosis followed by MVR, crystallizer, centrifuge and solar evaporation pond.
Quantity of treated effluent recycled to member units	:	1215 kld
Type and Quantity of salt recovered per day	:	Sodium sulphate 13 tons/day as liquid brine
Quantity of salt recycled into member units	:	Sodium sulphate 13 tons/day as liquid brine
Quantity of concentrated effluent sent to solar evaporation pond	:	8.2 kld
Quantity of impure salt generated per day	:	1.85 tons/day
Quantity of impure salt accumulated in storage shed	:	960 tons

Specific Observations:

(i) M/s Rayapuram Common Effluent Treatment Plant (P) Limited, has 25 member units out of which 12 member units are active.

(ii) The CETP was operating in the range of 20-30% of installed capacity since March 2012.

(iii) The CETP receives effluent through the underground pipeline by gravity. The CETP is operated for 7 days a week, while dyeing units are operating 5 days a week.

(iv) It is informed that the total production capacity of 10 member units is 5469 kg/day and their member units are consuming 25503 kg/day of sodium sulphate salt in dying process.

(v) The trade effluents are received in receiving tank of capacity 138 m^3 through closed conduit and taken to homogenization tank for uniform mixing followed by biological oxidation tank and primary clarifier. Sludge from primary clarifier is dewatered through thickener and filter press. The supernatant of the clarifier is pretreated in quartz filter for further reduction of suspended solids followed by resin filter for removal of colour and further treated through softener for reduction of hardness and to removal of color before treating it through Reverse Osmosis. HCl and NaOH is used as softener filter back washing and NaCl and H_2SO_4 for resin regeneration. Resin regeneration water is treated through soda ash treatment and supernatant is passed to crystallizer.

(vi) The unit has four stages RO with 3 skids in each RO with the capacity of 85 m^3/hr each. It is informed that RO permeate and condensate is being sent to member units through pipeline.

(vii) It is informed that around 60-70 % of RO reject having 130 GPL is sent to member units as a brine for reuse in dyeing in place of salt. The remaining 30 – 40% of the RO reject is concentrated through MVR. The unit has two MVR of capacity 250 KL/hr out of which one is stand-by. Condensate of MVR is sent to member units for use in the process, while concentrate is being further concentrated through MEE with 3 effect of falling film and 2 effect of forced circulation.

(viii) It is informed that around 13 tons/day pure salt in the form of liquid brine from the MVR is sent to member unit for reuse. The reported steam consumption at MVR is 300 kg/hr and steam consumption at MEE is 1.5 ton/hr .

(ix) After recovering the salt, MEE concentrate containing mixed salt is sent to solar evaporation pond of an area 2400 m^2. 960 tons of mixed salt collected from solar evaporation pond, 86 tons of chemical sludge and 161 tons of biological sludge are stored in the CETP premises.

Aeration Tank

Storage of mixed salts

(x) The unit has proposed to dispose biological sludge and mixed salt to M/s Tamil Nadu Waste Management Limited, Gummidipoondi (TSDF); and chemical sludge for co-processing at M/s Dalmia Cement Bharat Limited, Ariyalur.

(xi) Member units are charged an average of Rs. 350-400/kl. Expenditure towards manpower is RS. 30 lakh/ month and 20-25 lakh/month for chemicals. Fixed expenditure towards electricity and fuel is Rs. 5-6 lakh/month while variable cost is Rs. 25 lakh/month.

(xii) During inspection samples being collected at various points of CETP to verify the efficiency of ZLD system, the analysis results are depicted below:

Location of samples collected / **Parameters**	**Raw Effluent**	**After Softener**	**RO permeate**	**RO reject**
pH	10.12	8.13	5.82	8.13
TSS (mg/L)	7	5	6.50	2.31
TDS (mg/L)	9854	11000	210	36808
BOD (mg/L)	394	45	-	-
COD (mg/L)	620	151	-	-
Chloride (mg/L)	2644	2452	65.37	8652.6
Sulphate (mg/l)	2712	3134	24	-

Location of samples collected / **Parameters**	**MVR Condensate**	**MVR Concentrate**	**MEE Condensate**	**MEE Concentrate**	**Aeration tank**
pH	6.28	9.89	6.58	8.6	-

TSS (mg/L)	BDL	63.51	BDL	-	-
TDS (mg/L)	44	95944	66	180336	-
Chloride (mg/L)	5.768	23554	24516	67298	-
Sulphate (mg/l)	9.88	-	1.46	-	-
MLSS (mg/l)	-	-	-	-	1410

(xiii) From the analysis results RO efficiency is worked about 70.11 % . As per analysis results the solid concentration is increased from 3.68 to 9.59% through MVR and further it was increased upto 18.03% through MEE. As per the analysis results the MEE final concentrate which is being sent to solar evaporation is worked about 35.95kld.

3.4.3 M/s Veerapondi Common Effluent Treatment Plant (P) Limited

General Information:

Address of the CETP	:	**M/s Veerapandi Common Effluent Treatment Plant (P)Limited., SF No. 548/1, Karuppagoundampalayam, Cottom Market Post, Tirupur, Tamil Nadu.**
Installed capacity in MLD/KLD	:	12 MLD or 12000 KLd
Operating capacity in MLD	:	2.5 MLD or 2500 KLD
Number of member units	:	**72**
Sequences of treatment system exist to achieve ZLD	:	Receiving tank, equalization and neutralization tank, Aeration tank, tube settler, oxidation reduction process, OR sump, flash mixer, Secondary clarifier, dual media filter, ultra filtration, Activated carbon filter, Reverse osmosis followed by MVR, MEE and solar evaporation pond.
Quantity of treated effluent recycled to member units	:	2070 kld
Type and Quantity of salt recovered per day	:	Sodium sulphate – 5-6 tons/day
Quantity of salt recycled into member units	:	Sodium sulphate – 5-6 tons/day
Quantity of concentrated effluent sent to solar evaporation pond	:	5- 7 kld
Quantity of impure salt generated per day	:	1 – 1.5 tons/day
Quantity of impure salt accumulated in storage shed	:	215 tons

Specific Observations:

(i) M/s Veerapandi Common Effluent Treatment Plant (P) Limited has 72 member units, out of which 60 member units are actively operating.

(ii) The CETP was operating at 20% of installed capacity since 2011.

(iii) The unit receives effluent through pipeline. Informed that all the member units are using sodium sulphate salt in the process. 50% of the member units are exporters and remaining 50% are domestic suppliers.

(iv) The trade effluents are received in receiving tank through closed conduit by gravity. Sulphuric acid is added in equalization cum neutralization tank to neutralize the effluent. Neutralized effluent is being treated through aeration tank of capacity 8 MLD capacity provided with diffused aeration system and retention time of 16 hr is maintained. Overflow of aeration tank is passed to tube settler where 80 % of COD is reduced. Supernatant is passed to Oxidation Reduction Reactor (ORR) where chlorine gas is feed at the rate of 0.1 ppm.

(v) Treated effluent from ORR is collected in OR sump and sodium metabisulphate is added to remove residual chlorine. Lime is added in the flash mixer followed by secondary clarifier. Sludge from secondary clarifier and tube settlers are dewatered in filter press. Clarified effluent is collected and feed to DMF filter followed by Ultra-Filteration (UF) and activated carbon filter. The unit has 3 stage RO systems with each having 3 skids of capacity 200 m^3/hr with retention time of 20 hrs. Pretreated effluent is passed through RO and RO permeate is supplied to the member units along with condensate water. RO reject is passed to MVR followed by MEE. The unit has two MEE, one with 3 effects (120 kld) falling film and another with 2 effects (100kld) forced circulation. After concentration through MVR followed by MEE falling film evaporator, the concentrated effluent temperature being reduced to 10-12^o C through chiller and taken to crystallizer followed by centrifuge to recover salt. Further the mother liquor from centrifuge being concentrated through 2 effect forced circulation type MEE and finally sent to solar evaporation for recovering mixed salt through natural evaporation.

(vi) It is informed that Steam consumption at MVR is 1000 kg/hr; MEE (falling film) is 1000 kg/hr and in MEE (forced circulation) is 620 kg/hr.

(vii) It is informed that the CETP charges 4 paise per liter of permeate while the fresh water charges is 7 paise per liter and Rs 5/- per kg of CETP salt whereas outside price for salt is Rs. 14 per kg.

(viii) It is informed that around 5-6 tons/day of sodium sulphate is recovered and given back to the member units for reuse. 1-1.5 tons/day mixed salt recovered from solar evaporation pond and 215 tons of mixed salt is stored in the unit's premises. 15- 20 tons of ETP sludge is generated every month. ETP sludge is sent to M/s Ultratech Cement, Ariyalur for co-processing. It is informed that Rs. 2400/- per ton (Rs. 600- for processing, Rs. 1800/- for transportation) is paid to M/s Ultratech Cement towards transportation and co-process of ETP sludge in Cement Mill .

ORR system

RO system

Multiple Effect Evaporator

(ix) During inspection samples were collected at various points of CETP to verify the efficiency of ZLD system, the analysis results are depicted below:

Location of samples collected / Parameters	Raw Effluent	Equalization tank	Secondary Clarifier	RO Permeate	RO Reject
pH	9.1	6.6	10.9	5.3	6.92
EC (µs/cm)	14540	11360	14770	298	68800
TSS (mg/L)	170	80	49	10	161
TDS (mg/L)	12902	8487	10753	214	66735
BOD (mg/L)	446	316	3	___	9.4
COD (mg/L)	667	635	95	0	527.8
Chloride (mg/L)	1061	1254	1229	64	6581
Sulphate (mg/L)	4998	3786	3945	8	___

Location of samples collected / Parameters	MVR concentrate	MEE 1 Concentrate	MEE 2 Concentrate
pH	9.12	8.81	8.79
TSS (mg/L)	317	___	___
TDS (mg/L)	108995	___	___
Chloride (mg/L)	10389	___	___
Total Solids (mg/L)	___	434708	483162

(x) From the analysis results the RO efficiency is worked about 83.9 %. As per analysis results the solid concentration is increased from 6.68 to 10.9% through MVR and further it was increased upto 43.4% through MEE falling film to recover pure salt in the tune of 5-6 ton/day. As per the analysis results the MEE final concentrate which is being sent to solar evaporation is worked about 40 kld. Based on flow reading taken at different points of MVR and MEE during the inspection also confirms the same, the quantity of concentrated effluent sent to solar evaporation pond worked about 16 kld and found not matching each other .

3.4.4 M/s Mangalam Common Effluent Treatment Plant (P) Limited

General Information :

Address of the CETP	:	M/s Mangalam Common Effluent Treatment Plant, P)Limited., Mangalam Road, Tirupur, Tamil Nadu

Installed capacity in MLD/KLD	:	4 MLD or 4000 KLd
Operating capacity in MLD	:	0.6 MLD or 600 KLD
Number of member units	:	**14**
Sequences of treatment system exist to achieve ZLD	:	Receiving tank, homogenization tank, Aeration tank, secondary clarifier, ozone contact tank, Pressure sand filter, softening filter, Activated carbon filter, cartridge filter, Reverse osmosis followed by MVR.
Quantity of treated effluent recycled to member units	:	480 kld
Type and Quantity of salt recovered per day	:	-
Quantity of salt recycled into member units	:	-
Quantity of concentrated effluent sent to solar evaporation pond	:	-
Quantity of impure salt generated per day	:	-
Quantity of impure salt accumulated in storage shed	:	30 Ton

Specific Observations:

(i) M/s Mangalam Common Effluent Treatment Plant (P) Limited has 14 member units, out of which 7 member units are actively operating.

(ii) The CETP was operating at 15% of installed capacity since May 2013 on trail basis.

(iii) The unit receives effluent through pipeline. All the member units are using sodium sulphate salt in the process.

(iv) The trade effluents are received in receiving tank through closed conduit by gravity. After homogenization, aeration and clarification, effluent is passed to ozone contact tank for color removal. Liquid oxygen dosing is provided to the effluent at ozone contact tank. It is informed that 1800 m^3 of liquid oxygen is consumed in 2 days. Treated effluent is passed through pressure sand filter, softening filter activated carbon filter and cartridge filter prior to RO. ETP sludge is dewatered at filter press.

(v) The unit has 4 stage RO systems with each having 3 skids. Only 2 RO was in operational. RO permeate and MVR condensate is supplied to the member units. RO

reject is passed to MVR. MVR reject, known as brine is supplied to member units for reuse. The operation cost of CETP is Rs.450 per KLD

(vi) During inspection the CETP was found partial operation, RO and MVR found under repair, Hence the samples were not collected.

(vii) ZLD system was found inadequate the RO reject was found stored in the storage lagoon which also indicates the inadequacy of ZLD system.

3.4.5 M/s Arulupuram Common Effluent Treatment Plant (P) Limited

General Information :

Address of the CETP	:	M/s Arulupuram Common Effluent Treament Company Pvt., Ltd, Thalunjikattu thottam, Veerapandi (Via), Tirupur
Installed capacity in MLD/KLD	:	5.5 MLD or 5500 KLd
Operating capacity in MLD	:	3.850 MLD or 3850 KLD
Number of member units	:	**14**
Sequences of treatment system exist to achieve ZLD	:	Receiving tank, homogenization tank, neutralization tank, biological oxidation tank, secondary clarifier, hypochlorination tank, quartz filter, resign filter, softening filter, pressure filter, cartridge filter, Reverse osmosis followed by MVR, MEE with 5 effect of falling film and 3 effect of forced circulation system and solar evaporation pond.
Quantity of treated effluent recycled to member units	:	3272.5 kld (85%)
Type and Quantity of salt recovered per day	:	12.5 tons/day in terms of pure salt and brine solution
Quantity of salt recycled into member units	:	100% recycled
Quantity of concentrated effluent sent to solar evaporation pond	:	8 kld
Quantity of impure salt generated per day	:	3.2 tons/day
Quantity of impure salt accumulated in storage shed	:	Around 1300 tons (30 tons sent to TSDF for disposal)

Specific Observations:

(i) M/s Arulupuram Common Effluent Treatment Plant (P) Limited has 14 member units which are actively operating.

(ii) The CETP was operating at 70% of installed capacity since 2011.

(iii) Each member unit has four flow meters connected online to CETP such as flow meter for fresh water, effluent generation, brine received by the unit and brine utilized by the unit. The CETP is operating 5 days a week. The CETP is having three pipelines; one for receiving effluent from member units, second line for sending permeates water and 3rd line for sending brine solution to the member units..

(iv) It is informed that all member units are using sodium sulphate salt in the process and brine solution is reused in their process. In addition, excess pure salt is stored in the CETP.

(iv) The trade effluents are received in receiving tank through closed conduit by gravity. After homogenization and neutralization by adding 200 ppm H_2SO_4, effluent is treated in biological oxidation tank. Biologically treated effluent is clarified in secondary clarifier. Chlorine dose of 100 ppm is provided in hypochlorination tank to remove color followed by dosing sodium meta bisulphate (50ppm) to remove excess chlorine. Treated effluent is then passes through Quartz filter to remove SS and turbidity followed by resin filter to remove color and COD followed by softner filter to remove hardness and then treated through pressure filter and microcartridge filter before treating through RO. The resins are treated with HCl and H_2SO_4 .

(v) The unit has 4 stage RO, the CETP claims that they are recovering 80-85% of RO permeate. As per observation of team the RO efficiency was found 84%. RO permeate is distributed to the member units proportionally to the effluent received. RO reject is being concentrated in MVR to increase solid concentration from 3.5 % to 11 %. After achieving 11% solid concentration part of concentrated(11%) is being taken as brine solution preparation and remaining 89% being further concentrated through 5 effect falling film evaporator to achieve 30 % solid concentration. Part of MVR concentrate (11%) is being mixed with part of MEE concentrate to and sent to member units as brine solution after adding sulphuric acid for maintaining pH and chlorine gas to remove color and sodium meta bisulphate. The temperature of remaining concentrated effluent being reduced through chiller and taken to crystallizer to recover sodium sulphate pure salt. The mother liquor from crystallizer being further concentrated

through 3 effect forced circulation evaporator to achieve solid concentration of 40%. The concentrated effluent from forced circulation evaporator being sent to solar evaporation pond of 5000 m^2.

(vi) It is informed that 300 kg/day of biological sludge generated is stored in the unit's premises. Around 300- 400 tons of chemical sludge was sent to M/s Ultratech Cements at the price of Rs. 2000/ton for co-processing. Around 5000 tons of chemical sludge is stored in the CETP which is proposed to send to M/s Ultratech Cements.

RO system

MEE cum crystallizer to recover pure salt

(vii) It is informed that mixed salt of 3 tons/day is being generated from solar evaporation pond. Around 1300 tons of mixed salt is stored in the CETP premises.

(viii) The CETP is charging member units at the rate of Rs. 220/- kl of the effluent received.

(ix) During inspection samples being collected at various points of CETP to verify the efficiency of ZLD system, the analysis results are depicted below:

Location of samples collected / **Parameters**	**Raw Effluent**	**Aeration tank**	**Secondary Clarifier out let**	**RO feed**	**RO Permeate**	**RO reject**
pH	9.1	7.3	7.6	7.6	6.92	7.8
EC (µs/cm)	9900		9800	10270	271	-
TSS (mg/L)	-		-	-	-	-
TDS (mg/L)	4200		4200	4300	100	11800
BOD (mg/L)	190		11	2	BDL	-
COD (mg/L)	915		295	256	16	-
Chloride (mg/L)	742		670	550	21	-
Sulphate (mg/L)	2913		3194	2903	41	-
MLSS (mg/l)	-	620	-	-	-	-

Location of samples collected	**MVR**	**MVR**	**MEE**	**MEE**

Parameters	condensate	concentrate	Condensate	concentrate
pH	6.7	9.0	7.9	8.9
EC (µs/cm)	508	-	577	-
TSS (mg/L)	-	___	-	-
TDS (mg/L)	200	___	200	-
Sulphate (mg/L)	195		210	-
Chloride (mg/L)	-	___	-	-
Total Solids (mg/L)	___	130290	-	781780

(x) From the analysis results the RO efficiency is worked about 64 % only. As per analysis results the solid concentration is increased from 1.18 %to 13.0% through MVR and further it was increased upto 78.18 through MEE falling film to recover pure salt in the tune of 10-12 ton/day. As per the analysis results the MEE final concentrate which is being sent to solar evaporation is worked about 8-9 kld. Based on flow reading taken at different points of MVR and MEE during the inspection also confirms the same.

3.4.6 M/s PARK Common Effluent Treatment Plant (P) Limited

General Information :

Address of the CETP	:	M/s PARK CETP (P) Ltd., Anburam Knit Process, Pitchampalayam, Tirupur
Installed capacity in MLD/KLD	:	2.0 MLD or 2000 KLd
Operating capacity in MLD	:	1.4 MLD or 1400 KLD
Number of member units	:	**3**
Sequences of treatment system exist to achieve ZLD	:	Equalization tank, homogenization tank, Aeration tank, secondary clarifier, multigrade filter, micro grade filter, nanofilter, Reverse osmosis followed by MVR and MEE
Quantity of treated effluent recycled to member units	:	1120 kld (80%)
Type and Quantity of salt recovered per day	:	7.73 tons/day in terms of brine solution
Quantity of salt recycled into member units	:	100% recycled
Quantity of concentrated effluent sent to solar evaporation pond	:	3.4 kld
Quantity of impure salt generated per day	:	0.102 tons/day
Quantity of impure salt accumulated in storage shed	:	Around 74 tons

Specific Observations:

(i) M/s Park Common Effluent Treatment Plant (P) Limited has 3 member units, which are actively operating.

(ii) The CETP was operating at 70% of installed capacity.

(iii) The unit receives effluent through pipeline. All member units are using sodium chloride salt in the process. The CETP is operated for 6 days a week.

(iv) The trade effluents are received in equalization tank through closed conduit by gravity. After neutralization the effluent is provide with biological treatment and clarification. The secondary treated effluent being treated through microfiltration followed by Nano filteration. Nano filterate of 90% being treated through 2 stage RO to recover permeate of 85% the RO reject being concentrated through 5 effect falling film evaporator to achieve 180gpl, after achieving required concentration, the concentrate being sent to their member units as brine solution.

(v) The reject from the nano filtration is being treated through 3 stage RO system followed by 5 effect falling film evaporator and 1 effect forced circulation system. The concentrated effluent being finally sent to solar evaporation pond of 2600m^2 for recovering slat through natural evaporation. During inspection this system was found not in operation.

(vi) The 5 effect falling film evaporator is being used for both the stream. It is informed that 3 – 4 days in a week used for treating the brine solution stream and 1-2 days in a week used for treating the Nano reject.

(vii) The biological sludge and softening sludge from the ETP is dewatered in filter press and disposed in secured landfill site. The unit is charging member units Rs. 150/- kl for permeate and Rs. 150/- kl of brine solution.

(viii) During inspection the CETP was found under up gradation, microfiltration, RO-I, RO-II and MEE was found in operation.

(ix) During inspection samples being collected at various points of CETP to verify the efficiency of ZLD system, the analysis results are depicted below:

Location of samples collected / **Parameters**	**Raw Effluent**	**Aeration tank**	**Secondary Clarifier out let**	**Nano feed**	**Nano Permeate**	**Nano reject**	**RO- I & II feed**
pH	8.6	7.4	7.7	5.7	5.8	5.7	6.2
EC (µs/cm)	12620	-----	13200	13500	14130	14640	12790

TSS (mg/L)	---	-----	-	-	--	-	
TDS (mg/L)	6200	-----	6400	6400	6600	6900	6400
BOD (mg/L)	199.65	----	30.85	-	-	-	-
COD (mg/L)	946.72	-----	411.28	--	-	-	-
Chloride (mg/L)	4187	------	4523	-	-	-	-
Sulphate (mg/L)	335		1542	-	-	-	1055
MLSS (mg/l)		1700		-	-	-	-

Location of samples collected / **Parameters**	**RO I &II permeate**	**RO I & II reject**	**MEE feed**	**MEE condensate**	**MEE concentrate**
pH	5.3	5.7	6.1	8.4	7.8
EC (µs/cm)	65	-	-	1144	-
TSS (mg/L)	--	-	-	-	-
TDS (mg/L)	40	-	19400	600	-
Sulphate (mg/L)	6.3	6479	5414	66	-
Chloride (mg/L)	-	-	-	-	-
Total Solids (mg/L)	-	59760		-	201640

(x) From the analysis results the RO efficiency is worked about 90 %. As per analysis results the solid concentration is increased from 5.97 % to 20.16 % through MEE. After achieving 200 gpl the brine solution was being sent to their member units. Due to non-operation of other part of treatment system(viz Nano reject management) the efficiency of ZLD system was not verified.

3.4.7 M/s Chinnakkarai Common Effluent Treatment Plant (P) Limited

General Information :

Address of the CETP	:	M/s Chinnakkarai Common Effluent Treament Company Pvt., Ltd, Veerpandi village, Tirupur
Installed capacity in MLD/KLD	:	8.00 MLD or 8000 KLd
Operating capacity in MLD	:	1.5 – 2.0 MLD or 1500 - 2000 KLD
Number of member units	:	**23**
Sequences of treatment system exist to achieve ZLD	:	Receiving tank, homogenization tank, biological oxidation tank, secondary clarifier, hypochlorination tank, quartz filter, resign filter, softening filter, pressure filter, cartridge filter, Reverse osmosis followed by MVR, MEE with 4 effect of forced circulation system and solar evaporation pond.
Quantity of treated effluent recycled to member units	:	1326 kld (78%)

Type and Quantity of salt recovered per day	:	3-4 tons/day in terms of pure salt and brine solution
Quantity of salt recycled into member units	:	100% recycled
Quantity of concentrated effluent sent to solar evaporation pond	:	3.0 -3.5 kld
Quantity of impure salt generated per day	:	-
Quantity of impure salt accumulated in storage shed	:	Around 2500 tons

Specific Observations:

(i) M/s Chinnakkarai Common Effluent Treatment Plant (P) Limited has 23 member units which are actively operating.

(ii) The CETP was operating at 30% of installed capacity since 2009.

(iii) Each member unit has four flow meters connected online to CETP such as flow meter for fresh water, effluent generation, brine received by the unit and brine utilized by the unit. The CETP is having three pipelines; one for receiving effluent from member units, second line for sending permeates water and 3rd line for sending brine solution to the member units..

(iv) It is informed that all member units are using sodium sulphate salt in the process and brine solution is reused in their process. In addition, excess pure salt is stored in the CETP.

(iv) The trade effluents are received in receiving tank through closed conduit by gravity. After homogenization and neutralization by adding 200 ppm H_2SO_4, effluent is treated in biological oxidation tank. Biologically treated effluent is clarified in secondary clarifier. Chlorine dose of 100 ppm is provided in hypochlorination tank to remove color followed by dosing sodium meta bisulphate (50ppm) to remove excess chlorine. Treated effluent is then passes through Quartz filter to remove SS and turbidity followed by resin filter to remove color and COD followed by softner filter to remove hardness and then treated through pressure filter and microcartridge filter before treating through RO. The resins are treated with HCl and H_2SO_4 .

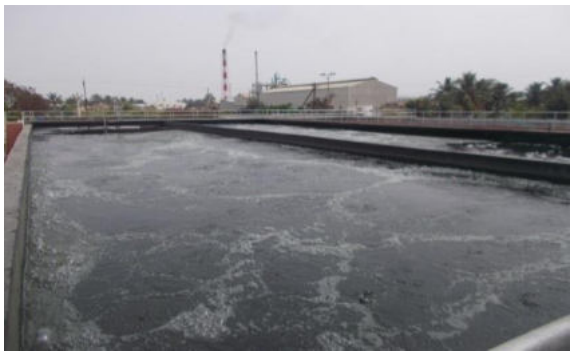
(v) The unit has 3 stage RO, the CETP claims that they are recovering 80-85% of RO permeate. As per observation of team (based on flow reading) the RO efficiency was found 85.3%. RO permeate is distributed to the member units proportionally to the effluent received. RO reject is being concentrated in MVR to increase solid

concentration from 3.5 % to 11 %. After achieving 11% solid concentration, around 70-75 % of MVR concentrated is being taken as brine solution preparation (after adding sulphuric acid for maintaining pH and chlorine gas to remove color and sodium meta bisulphate into MVR concentrate and the same being sent to their member units to utilize in the dying process) and remaining 25-30 % being further concentrated through 4 effect falling film evaporator to achieve 45 % solid concentration. The temperature of remaining concentrated effluent being reduced through chiller and taken to crystallizer to recover sodium sulphate pure salt. The mother liquor from crystallizer being sent to solar evaporation pond of 3296 m^2.

(vi) It is informed that 2.1 t/m of biological sludge and 6.5 t/m of chemical sludge is being generated and the same being stored in the unit's premises. Around 403 tons of chemical sludge was sent to M/s Ultratech Cements.

(vii) It is informed that mixed salt of 2-3 tons/day is being generated from solar evaporation pond. Around 2500 tons of mixed salt is stored in the CETP premises.

(viii) The CETP is charging member units at the rate of Rs. 334/- kl of the effluent received. The cost saved due to utilize of RO permeate, brine solution and slat is Rs. 160.60/kl, the net cost for treatment of effluent is only Rs. 172.5/kl(Rs. 334 – 160.60))



Biological oxidation tank

Storage of recovered pure salt (sodium sulphate)

Accumulated mother liquor in solar evaporation pond

(ix) During inspection samples being collected at various points of CETP to verify the efficiency of ZLD system, the analysis results are depicted below:

Location of samples collected / **Parameters**	**Raw Effluent**	**Aeration tank**	**Secondary Clarifier out let**	**RO feed**	**RO Permeate**	**RO reject**
pH	9.2	103	8.2	7.8	4.9	8.1
EC (µs/cm)	12090	-	13220	13400	145	-
TSS (mg/L)	88	-	12	BDL	08	22
TDS (mg/L)	10270	-	9486	9760	104	-
BOD (mg/L)	392	-	6.5	-	-	-
COD (mg/L)	918	-	203	204	BDL	-
Chloride (mg/L)	71851	-	1806	-	-	-
Sulphate (mg/L)	3185	-	3075	-	-	-
Total Hardnes (mg/l)	-	-	144	27	1.9	67.3
Total solids (mg/l)						43603
MLSS (mg/l)	-	3775	-	-	-	-

Location of samples collected / **Parameters**	**MVR condensate**	**MVR concentrate**	**MEE Condensate**	**MEE concentrate**
pH	8.1	9.6	7.7	9.3
EC (µs/cm)	1175	-	996	-
TSS (mg/L)	-	___	-	-
TDS (mg/L)	698	___	550	-
Sulphate (mg/L)	195		-	-
Chloride (mg/L)	-	___	-	-
Total Solids (mg/L)	___	117684	-	229557
Fixed solids (mg/l)	-	-	-	224623
Volatile solids (mg/l)	-	-	-	4935

(x) From the analysis results the RO efficiency is worked about 77.6% only. As per analysis results the solid concentration is increased from 4.36 to11.70% through MVR and further it was increased upto 22.3 through MEE to recover pure salt in the tune of 3-4 ton/day. As per the analysis results the MEE final concentrate which is being sent to solar evaporation is worked about 40 kld.

3.4.8 M/s Tiruppur Murgampalyam Common Effluent Treatment Plant (P) Limited

General Information :

Address of the CETP	:	M/s Tiruppur Murugampalayam Common Effluent Treatment Company

		Pvt., Ltd, Veerpandi village, Tirupur
Installed capacity in MLD/KLD	:	11 MLD or 11000 KLd
Operating capacity in MLD	:	2.2 MLD or 2200 KLD
Number of member units	:	**39**
Sequences of treatment system exist to achieve ZLD	:	Receiving tank, homogenization tank, biological oxidation tank, secondary clarifier, hypochlorination tank, quartz filter, resign filter, softening filter, pressure filter, cartridge filter, Reverse osmosis followed by MVR, MEE with 3 effect of forced circulation system and solar evaporation pond.
Quantity of treated effluent recycled to member units	:	1870 kld (85%)
Type and Quantity of salt recovered per day	:	Brine solution
Quantity of salt recycled into member units	:	100% recycled
Quantity of concentrated effluent sent to solar evaporation pond	:	10-15 kld
Quantity of impure salt generated per day	:	-
Quantity of impure salt accumulated in storage shed	:	-

Specific Observations:

(i) M/s Tiruppur Murugampalayam Common Effluent Treatment Plant (P) Limited has 39 member units which are actively operating.

(ii) The CETP was operating at <30% of installed capacity since 2010.

(iii) Each member unit has four flow meters connected online to CETP such as flow meter for fresh water, effluent generation, brine received by the unit and brine utilized by the unit. The CETP is having three pipelines; one for receiving effluent from member units, second line for sending permeates water and 3rd line for sending brine solution to the member units..

(iv) It is informed that all member units are using sodium sulphate salt in the process and brine solution is reused in their process. In addition, excess pure salt is stored in the CETP.

(iv) The trade effluents are received in receiving tank through closed conduit by gravity. After homogenization and neutralization by adding 200 ppm H_2SO_4, effluent is treated

in biological oxidation tank. Biologically treated effluent is clarified in secondary clarifier. Chlorine dose of 100 ppm is provided in hypochlorination tank to remove color followed by dosing sodium meta bisulphate (50ppm) to remove excess chlorine. Treated effluent is then passes through Quartz filter to remove SS and turbidity followed by resin filter to remove color and COD followed by softner filter to remove hardness and then treated through pressure filter and microcartridge filter before treating through RO. The resins are treated with HCl and H_2SO_4 .

(v) The unit has 4 stage RO, the CETP claims that they are recovering 80-85% of RO permeate. As per observation of team (based on flow reading) the RO efficiency was found 84.5%. RO permeate is distributed to the member units proportionally to the effluent received. RO reject is being concentrated in MVR to increase solid concentration from 3.5 % to 10 %. After achieving 10% solid concentration, around 60 % of MVR concentrated is being taken as brine solution preparation (after adding sulphuric acid for maintaining pH and chlorine gas to remove color and sodium meta bisulphate into MVR concentrate and the same being sent to their member units to utilize in the dying process) and remaining 40 % being further concentrated through 3 effect forced circulation evaporator to achieve 30 % solid concentration.The concentrated effluent being sent to solar evaporation pond of 5094 m^2.

(vi) It is informed that 0.48 t/m of biological sludge and 3.76 t/m of chemical sludge is being generated and the same being stored in the unit's premises.

(vii) It is informed that mixed salt of 0.74 tons/day is being generated from solar evaporation pond. Around 351 tons of mixed salt is stored in the CETP premises.

Chlorination system

MVRE system for concenteration

MEE with 3 effect forced circulation system

Solar ponds for natural evaporation of concenterated effluent

(viii) The CETP is charging member units at the rate of Rs. 204/- kl of the effluent received. The cost saved due to utilize of RO permeate, brine solution and slat is Rs 150.4/kl, the net cost for treatment of effluent is only Rs. 53.6/kl(Rs. 204 – 150.4)

(ix) During inspection samples being collected at various points of CETP to verify the efficiency of ZLD system, the analysis results are depicted below:

Location of samples collected / **Parameters**	**Raw Effluent**	**Aeration tank**	**Secondary Clarifier out let**	**RO feed**	**RO Permeate**	**RO reject**
pH	9.4	-	8.4	7.8	6.1	8.5
EC (µs/cm)	11040	-	11550	11950	277	-
TSS (mg/L)	-	-	-	22	BDL	22
TDS (mg/L)	7900	-	8476	8498	162	-
BOD (mg/L)	467	-	6.5	-	-	-
COD (mg/L)	1026	-	205	176	BDL	-
Chloride (mg/L)	346	-	1554	-	-	-
Sulphate (mg/L)	1482	-	2079	-	-	-
Total Hardnes (mg/l)	-	-	250	48	-	154
Total solids (mg/l)	-		-			39380
Fixed Solids (mg/L)	-	-	-	-	-	38200
volatile solids (mg/l)						11800
MLSS (mg/l)	-	3483	-	-	-	-

Location of samples collected / **Parameters**	**MVR condensate**	**MVR concentrate**	**MEE Condensate**	**MEE concentrate**
pH	8.0	9.9	6.2	9.9
EC (µs/cm)	211	-	749	-
TSS (mg/L)	-	___	-	-

TDS (mg/L)	94	___	438	-
Sulphate (mg/L)	-		-	-
Chloride (mg/L)	-	___	-	-
Total Solids (mg/L)	___	94092	-	308521
Fixed solids (mg/l)	-	91804	-	303127
Volatile solids (mg/l)	-	2288	-	5395

(x) From the analysis results the RO efficiency is worked about 78.4% only. As per analysis results the solid concentration is increased from 3.9 to 9.4% through MVR and further it was increased upto 30.85 % through MEE and sent to solar evaporation pond.. As per the analysis results the MEE final concentrate which is being sent to solar evaporation is worked about 20-25 kld.

3.4.9 M/s Kallikadu Common Effluent Treatment Plant (P) Limited

General Information :

Address of the CETP	:	M/s Kallikadu Common Effluent Treatment Company Pvt., Ltd, Kallikadu thottam, Karuvampalyam, Tirupur
Installed capacity in MLD/KLD	:	3 MLD or 3000 KLd
Operating capacity in MLD	:	0.9 MLD or 900 KLD
Number of member units	:	**12**
Sequences of treatment system exist to achieve ZLD	:	Receiving tank, homogenization tank, biological treatment, secondary clarifier, ORP, pressure filter, Activated Carbon filter, Reverse osmosis followed by MVR and solar evaporation pond.
Quantity of treated effluent recycled to member units	:	765 kld (85%)
Type and Quantity of salt recovered per day	:	Brine solution
Quantity of salt recycled into member units	:	100% recycled
Quantity of concentrated effluent sent to solar evaporation pond	:	-
Quantity of impure salt generated per day	:	-
Quantity of impure salt accumulated in storage shed	:	-

Specific Observations:

(i) M/s Kallikadu Common Effluent Treatment Plant (P) Limited has 12 member units which are actively operating.

(ii) The CETP was operating at <30% of installed capacity since 2008.

(iii) Each member unit has four flow meters connected online to CETP such as flow meter for fresh water, effluent generation, brine received by the unit and brine utilized by the unit. The CETP is having three pipelines; one for receiving effluent from member units, second line for sending permeates water and 3rd line for sending brine solution to the member units..

(iv) It is informed that all member units are using sodium chloride salt in the process and brine solution is reused in their process.

(iv) The trade effluents are received in receiving tank through closed conduit by gravity. After homogenization and neutralization by adding H_2SO_4, effluent is treated in biological treatment. Biologically treated effluent is clarified in secondary clarifier. Chlorine gas dose is provided to remove color followed by dosing sodium meta bisulphate (50ppm) to remove excess chlorine. Treated effluent is then passes through pressure filter and Activated carbon filtre before treating through RO.

(v) The unit has 4 stage RO, the CETP claims that they are recovering 80-85% of RO permeate. As per observation of team (based on flow reading) the RO efficiency was found 83.47%. RO permeate is distributed to the member units proportionally to the effluent received. RO reject is being concentrated in MVR to increase solid concentration from 3.5 % to 10 %. After achieving 10% solid concentration, around 28 kld of MVR concentrated is being taken as brine solution preparation (after adding sulphuric acid for maintaining pH and chlorine gas to remove color and sodium meta bisulphate into MVR concentrate and the same being sent to their member units to utilize in the dying process) and remaining is sent to solar evaporation ponds..

Chlorine gas dosing system to remove colour

Brine preparation tank

Storage of excess MVR concentrate

(vii) It is informed that 5-6 t/a of biological sludge and 150 t/a of chemical sludge is being generated and the same being stored in the unit's premises. The chemical sludge stored was sent to cement plant for co-processing.

(viii) The CETP is charging member units at the rate of Rs. 250/- kl of the effluent received. The cost saved due to utilize of RO permeate, brine solution is Rs 70/kl, the net cost for treatment of effluent is only Rs. 180/kl(Rs. 250-70).

(ix) During inspection samples being collected at various points of CETP to verify the efficiency of ZLD system, the analysis results are depicted below:

Location of samples collected / **Parameters**	**Raw Effluent**	**Aeration tank**	**Secondary Clarifier out let**	**RO feed**	**RO Permeate**	**RO reject**
pH	8.5	-	7.2	6.9	6.1	7.8
EC (µs/cm)	18060	-	19090	19110	766	63700
TSS (mg/L)	42	-	BDL	BDL	-	-
TDS (mg/L)	12444	-	12642	12602	352	-
BOD (mg/L)	201	-	BDL	2.1	-	-
COD (mg/L)	335	-	76	16	1.3	-
Chloride (mg/L)	-	-	6652	6061	-	-
Sulphate (mg/L)	-	-	1187	1343	-	-
Total Hardnes (mg/l)	907	-	869	50.2	-	-
Total solids (mg/l)	-		-			48923
Fixed Solids (mg/L)	-	-	-	-	-	48068
volatile solids (mg/l)						855
MLSS (mg/l)	-	6300	-	-	-	-

Location of samples collected / Parameters	MVR feed	MVR concentrate	MVR Condensate
pH	7.0	8.6	8.6
EC (µs/cm)	58600	119800	43
TSS (mg/L)	-	___	-
TDS (mg/L)	-	___	32
Sulphate (mg/L)	-		-
Chloride (mg/L)	-	___	-
Total Solids (mg/L)	43868	105932	-
Fixed solids (mg/l)	43040	104820	-
Volatile solids (mg/l)	828	1112	-

(x) From the analysis results the RO efficiency is worked about 75% only. As per analysis results the solid concentration is increased from 4.8 to 10.59% through MVR and the same being sent to their member units as brine solution and balance around 70 kld sent to solar evaporation ponds..

3.5 Individual Effluent Treatment Plants studied:

3.5.1 M/s Jayavishnu Textile Dyeing Unit

General Information :

Address of the CETP	:	M/s Jayavishnu Textile dyeing Unit
Production capacity (consented)	:	20 ton/day
Operating at	:	12 ton/day
Installed capacity in MLD/KLD	:	2 MLD
Operating capacity in MLD	:	0.65 MLD
Sequences of treatment system exist to achieve ZLD	:	Receiving tank, neutralization and homogenization tank, dissolved air flotation, anaerobic digester, plate settler, aeration tank, secondary clarifier, chemical dosing tank, tertiary clarifier, multigrade filter, ultra filter, reverse osmosis followed by MEE, crystallizer, centrifuge and solar evaporation pond.
Quantity of treated effluent recycled in the process	:	0.63 MLD
Type and Quantity of salt recovered per day	:	Sodium sulphate – 1.7 tons/day
Quantity of salt recycled in the process	:	Sodium sulphate – 1.7 tons/day
Quantity of concentrated effluent	:	2 kld

sent to solar evaporation pond		
Quantity of impure salt generated per day	:	200 kg/day
Quantity of impure salt accumulated in storage shed	:	6 tons

Specific Observations:

(i) M/s Jaiavishnu Textile Process (P) Ltd is a textile unit with installed capacity of 20 tons/day. During inspection the unit was operating at 12 tons/day.

(ii) The unit is involved in dyeing of cotton material. It is informed that, the unit was member of Arulupuram CETP till 2013. After that it established its own ETP in August, 2013.

(iii) The unit is consuming 7.5 MLD of water out of which 6.9 MLD is RO permeate and 0.6 MLD is fresh water. The water is being used for dyeing, rinsing and washing. It is informed that reactive dyes and sodium sulphate salt is used in the process.

(iv) The effluent from the process is being collected in receiving tank and passed through screening bar to neutralization tank and homogenization tank. Sulphuric acid dose is given in the neutralization tank to neutralize the pH of the effluent. In dissolved air flotation (DAF), dissolved air is mixed and floating material is scoped and effluent is passed to anaerobic tank and provided retention time of 2 days. Anaerobically treated effluent is taken to aeration tank, which has 4 chambers with baffle and diffused aerators.

(v) The effluent from aeration tank is being taken to secondary clarifier. Poly aliminium chloride (300 ppm), poly cation (200 ppm) and poly electrolyte (2 ppm) are added to the supernatant of the secondary clarifier and taken to tertiary clarifier for separation of sludge. The effluent from tertiary clarifier being treated through multi-grade filter (sand and carbon filter) and ultra-filter prior to RO.

(vi) The unit has three stages RO and five effect multiple effect evaporator comprises of 3 effects are falling film type and 2 effects are forced circulation type. Permeate from RO and condensate from MEE is used in the process. The RO reject being concentrated through 3 effect falling film evaporator, the temperature of concentrated effluent being reduced to 10-12^{o}C and recovered pure salt through crystallizer/centrifuge, the mother liquor being further concentrated through 2 effect

forced circulation evaporator, the concentrated effluent being sent to solar evaporation.

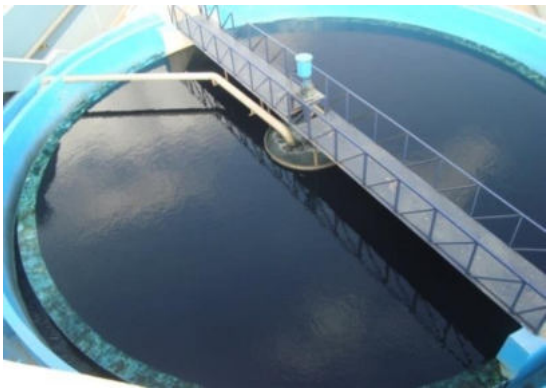
(vii) The unit has constructed the solar evaporation ponds on the terrace of the building. The solar evaporation ponds spread over an area of 1000 m^2.

(viii) It is informed that Steam consumption at MEE is 1600 kg/hr. RO is operated 10-11 hr/day and MEE is operated 3 days a week.

(ix) It is informed that 3 tons of salt is generated per day. If unit involves in dark color dying process the entire recovered salt being utilized, if light color dyeing process requires less salt which results in accumulation of recovered salt. During inspection around 10 tons of recovered pure salt is stored in the unit premises since 2 months.

(x) The impure salt from solar evaporation pond being stored under shed.

Homoginization tank



Primary clarifier

Ultra filtration skid

Biological Sludge

Solar evaporation ponds constructed on terrace of the building

(xi) During inspection CETP was in partial operation, samples being collected at various points of CETP to verify the efficiency of ZLD system, the analysis results are depicted below:

Location of samples collected / **Parameters**	**Raw Effluent**	**Tertiary Clarifier**	**RO Permeate**	**RO Reject**	**MEE Feed**	**MEE Concentrate**
pH	8.6	8.5	6.6	8.3	8.63	9.63
EC (µs/cm)	4	5	122.2	37900	37.5	127.6
TSS (mg/L)	138	19	2	87	-	-
TDS (mg/L)	2526	3478	165	34780	-	-
BOD (mg/L)	152	02	-	28	-	-
COD (mg/L)	691	79	BDL	556	-	-
Chloride (mg/L)	116	241	5	3028	-	-
Sulphate (mg/L)	1113	2345	4	17712	-	-
Total Solids (mg/L)	-	-	-	-	82638	386156

(xii) From the analysis results the RO efficiency is worked about 89.9% only. As per analysis results the solid concentration is increased from 3.79 to 38.61% through MEE falling film, after recovering pure salt, the mother liquor being further concentrated through MEE forced circulation . However during monitoring MEE forced circulation was not in operation. As per the analysis results the MEE final concentrate which is being sent to solar evaporation is worked about 4-5 kld.

3.5.2. M/s Royal Classic Mills Pvt Ltd

General Information :

Address of the CETP	:	M/s Royal classic Mills Pvt., Ltd., Karaipudur village, Arulpuram PO, Tirupur.
Production capacity (consented)	:	Dying of cotton fabrics and yarn – 38.52 ton/day Bleaching of fabrics & yarn – 26.32 tons/day
Operating at	:	65-70 % of installed capacity
Installed capacity in MLD/KLD	:	3.0 MLD or 3000 KLD
Operating capacity in MLD	:	1.5 -2.0 MLD or 1500 – 2000 KLD
Sequences of treatment system exist to achieve ZLD	:	Receiving tank, Primary clarifier, biological aeration tank, biological settling, tertiary clarifier, ultra filter, reverse osmosis, nano filtration followed by MEE and solar evaporation pond.
Quantity of treated effluent recycled in the process	:	80 - 85 % of Treated effluent recovered through RO being recycled in process
Type and Quantity of salt recovered per day	:	Sodium chloride as brine solution
Quantity of salt recycled in the process	:	5000 litres (90 %) of brine solution being utilised in the process in
Quantity of concentrated effluent sent to solar evaporation pond	:	15 kld
Quantity of impure salt generated per day	:	0.5 tons/day
Quantity of impure salt accumulated in storage shed	:	Around 3000 tons

Specific Observations:

(i) M/s Royal Classic Mills (P) Ltd is a textile unit with installed capacity of 38.52 t/day of Dyeing of hosiery fabrics & yarn and 26.32 t/day of bleaching of hosiery fabric & yarn. During monitoring the unit was in operation at 60 % of installed capacity.

(ii) The unit was consuming 3.25 MLD of water out of which 2.9 MLD is RO permeate and 0.325 MLD is fresh water. The water is being used for bleaching, dyeing, rinsing and washing. It is informed that reactive dyes are used for cotton fabrics/yarn and dispersive dyes are used synthetic fabrics/yarn. The unit is using sodium chloride salt in dyeing process in which 75 % of salt requirement is meeting through

recovered brine solution from nano filtration and 25 % of fresh salt being used during dyeing process.

(iii) It is informed that the unit maintains 1: 5 material to liquor ratio in each bath and each batch requires 10 baths. 110 kg of chemicals and 40 kg of sodium chloride salt is used in process per ton of fabric. Total 50 m^3 of water is used per ton of fabric, out of which 45 m^3 is RO permeate and 5 m^3 is fresh water is used per ton of fabric .

(iii) The unit has ETP of capacity 3000 m^3 but operating at 2000 m^3. The unit is involved in dyeing and bleaching of yarn and fabric. The unit has established its own ETP.

(iv) The effluent having TDS around 6000 mg/l and temperature 56-60^o C is received in the receiving tank and taken to primary clarifier. Feric chloride (300 ppm) and lime (200ppm) is added in primary clarifier. Effluent is then treated through biological treatment system followed by tertiary clarifier. Cationic coagulant (200ppm) and anionic coagulant (ppm) are added before in tertiary clarifier. Supernatant is feed to ultra-filtration and then to RO .

(v) The unit has four stage RO of capacity 3000 kld . Permeate is used in the process and reject is passed through nano filter and brine having TDS of 60000 mg/l is recovered and reused in the process as a brine solution. Reject from nano filter is concentrated through feed to MEE.

(vi) The unit has 5 effects of falling film evaporator (feed rate 2 ton/hr) and 3 effects of forced circulation evaporator (feed rate 1. 2 ton/hr). The final concentrated effluent of 15 m3/day being sent to solar evaporation ponds of 9748 m2.

Effluent Receiving tank

Aeration tank

(vii) The sludge generated from chemical treatment and biological treatment system of around 10 m3/day of sludge being de-watered in monobelt filter press and the sludge

generated is stored in secured land fill. During inspection it was observed that around 2026 tons of sludge is stored in the SLF.

(viii) The reported operational cost of ETP is Rs. 350/ m^3.

(ix) The house keeping in the ETP area was found very poor, all solar evaporation ponds are found totally filled.

(x) During inspection samples being collected at various points of ETP to verify the efficiency of ZLD system, the analysis results are depicted below:

Location of samples collected / **Parameters**	**Raw Effluent**	**Aeration tank**	**Tertiary Clarifier out let**	**RO feed**	**RO Permeate**	**RO reject**
pH	10.07	7.75	7.01	6.65	5.72	7.14
EC (µs/cm)	8310	-	8710	8890	246	-
TSS (mg/L)	-	-	-	-	-	-
TDS (mg/L)	3300	-	3800	3800	100	-
BOD (mg/L)	363	-	BDL	-	BDL	-
COD (mg/L)	776	-	31.2	176	9.41	-
Sulphate (mg/L)	104	-	128	159	9.27	317
Total solids (mg/l)	-		-	-		7100
MLSS (mg/l)	-	8320	-	-	-	-

Location of samples collected / **Parameters**	**ME – I feed**	**MEE -I Condensate**	**MEE - I concentrate**	**MEE -II Feed**	**MEE -II Condensate**	**MEE - II concentrate**
pH	6.46	7.12	7.54	6.02	8.3	7.2
EC (µs/cm)	-	211	-	-	-	-
TSS (mg/L)	-	___	-	-	-	-
TDS (mg/L)	16500	100	-	-	100	-
Sulphate (mg/L)	1175	34	5936	2888	31.7	7192
Total Solids (mg/L)	___	-	260740	121830	-	298770

(x) From the analysis results the RO efficiency is worked about 46.4% only. As per analysis results the solid concentration is increased from 0.71 to 26% through MEE falling film Evaporator. After recovering pure salt the mother liquor is further concentrated from 12.18 – 29.8% of solid concentration through MEE forced circulation system and sent to solar evaporation pond. As per the analysis results the MEE final concentrate which is being sent to solar evaporation is worked about 3.85 kld.

3.5.3 M/s Victus Dyeing (P) Ltd

General Information :

Address of the CETP	:	M/s VICTUS DYEING Karaipudur village, Palladam Tq, Tirupur.
Production capacity (consented)	:	Dyeing bleaching & washing of knitted fabrics --- 31 tons/day
Operating at	:	17 tons/day
Installed capacity in MLD/KLD	:	1.6 MLD or 1600 KLD
Operating capacity in MLD	:	1.15 MLD or 1150 KLD
Sequences of treatment system exist to achieve ZLD	:	Receiving tank, Primary clarifier, aeration tank, secondary clarifier, tertiary clarifier, reverse osmosis, followed by MEE and solar evaporation pond.
Quantity of treated effluent recycled in the process	:	85 - 89 % of Treated effluent recovered through RO being recycled in process
Type and Quantity of salt recovered per day	:	Sodium sulphate 6tons/day as pure salt
Quantity of salt recycled in the process	:	100%
Quantity of concentrated effluent sent to solar evaporation pond	:	5 kld
Quantity of impure salt generated per day	:	1.75 tons/day
Quantity of impure salt accumulated in storage shed	:	Around 3000 tons

Specific Observations:

(i) M/s Victus Dyeing (P) Ltd is a textile unit with installed capacity of 927 tons/month or 31 tons/day and operating capacity at 350-500 tons/moth.

(ii) The unit is involved in bleaching, dyeing and washing of yarn & fabric. Sodium sulphate salt is used in the process.

(iii) The unit has established its own ETP of capacity 1600 kld and operating at 1150 KLD.

(iv) The effluent of pH 9-10 is received in the receiving tank and treated through to primary clarifier. Sulphuric acid dosing is provided in the out let of receiving tank itself to neutralize the effluent. The clarified effluent from primary clarifier is being treated through biological treatment system followed by secondary clarifier. The clarified effluent being taken to holding where Cationic coagulant (200ppm) and anionic coagulant (300ppm) are added before tertiary clarifier. The supernatant from tertiary clarifier is being treated through pressure sand filters followed by cartridge filter before feeding to RO .

(vi) The unit has three stage RO system, the RO permeate being used in the process, the RO reject is being concentrated through 5 effect falling film evaporator, the temperature of concentrated effluent being reduced to 10- 12^{o}C to facilitate the crystal formation of sodium salt. After recovering the salt the mother liquor being further concentrated through forced circulation evaporator the final concentrated effluent being sent to solar evaporation ponds of area 1600 m^2.

(vii) It is informed that the operating cost of treatment system is around Rs170-184/m^3.

(viii) The reported steam consumption in MEE is 2.24 ton/hr .

Biological sludge

Accumulated salt in solar evaporation

(ix) The house keeping in the ETP area was found very poor. The chemical dosage practiced also found unscientific way, without any dosage regulation chemicals are added in unskilled manner.

(x) The operation of RO system and MEE also found not satisfactory.

(xi) Solar evaporation ponds are filled totally with concentrated effluent which also indicates the poor operation and maintenance of ETP.

(xii) During inspection samples being collected at various points of ETP to verify the efficiency of ZLD system, the analysis results are depicted below:

Location of samples collected / **Parameters**	**Raw Effluent**	**Aeration tank**	**Secondary Clarifier out let**	**RO feed**	**RO Permeate**	**RO reject**
pH	9.6	7.7	7.9	6.8	6.9	7.7
EC (µs/cm)	7450	-	9900	9970	-	13800
TSS (mg/L)	-	-	-	-	-	-
TDS (mg/L)	3200	-	4300	5300	11	-
BOD (mg/L)	260	-	9	-	BDL	-
COD (mg/L)	916	-	233	-	8.1	-

Sulphate (mg/L)	2180	-	128	340	-	-
Chloride (mg/l)	139	-	191		-	2417
Total solids (mg/l)	-		-	-	-	11790
MLSS (mg/l)	-	4510	-	-	-	-

Location of samples collected / **Parameters**	**MEE -I Condensate**	**MEE - I concentrate**	**MEE -II Condensate**	**MEE - II concentrate**
pH	8.6	8.4	8.6	7.5
EC (µs/cm)	126	-	156	-
TSS (mg/L)	-	-	-	-
TDS (mg/L)	100	-	100	-
Sulphate (mg/L)	20	-	43.9	-
Total Solids (mg/L)	-	271870	-	459890

(x) From the analysis results the RO efficiency is worked about 55% only. As per analysis results the solid concentration is increased from 1.17 to 27% through MEE falling film Evaporator. After recovering pure salt the mother liquor is further concentrated to 45.98% solid concentration through MEE forced circulation system and sent to solar evaporation pond. As per the analysis results the MEE final concentrate which is being sent to solar evaporation is worked about 10 kld.

3.5.4 M/s Mercury Process (P) Ltd

General Information :

Address of the IETP	:	M/s Mercury Process Veerapandi Village, Tiruppur Tq, Tirupur.
Production capacity (consented)	:	Dyeing of fabrics --- 12 tons/day
Operating at	:	12 tons/day
Installed capacity of IETP in MLD/KLD	:	0.90 MLD or 900 KLD
Operating capacity in MLD	:	0.8 MLD or 800 KLD
Sequences of treatment system exist to achieve ZLD	:	Collection tank, chemical dosage tanks, Primary clarifier, aeration tank, secondary clarifier, chemical dose cum tertiary clarifier, reverse osmosis, followed by MEE and solar evaporation pond.
Quantity of treated effluent recycled in the process	:	89 % of Treated effluent recovered through RO being recycled in process
Type and Quantity of salt recovered per day	:	Sodium sulphate 2 tons/day as pure salt

Quantity of salt recycled in the process	:	100%
Quantity of concentrated effluent sent to solar evaporation pond	:	5 -7 kld
Quantity of impure salt generated per day	:	1000kig/3 month
Quantity of impure salt accumulated in storage shed	:	-

Specific Observations:

(i) M/s Mercury Process is a textile unit with installed capacity of 12 t/d and operating at 90% of installed capacity.

(ii) The unit is involved in dyeing and washing of yarn & fabric. Sodium sulphate salt is used in the process.

(iii) The unit has established its own ETP of capacity 900 kld and operating at 800 KLD.

(iv) The effluent of pH 9-10 is received in the receiving tank and treated through to primary clarifier. Sulphuric acid dosing is provided in the out let of receiving tank itself to neutralize the effluent. The clarified effluent from primary clarifier is being treated through biological treatment system followed by secondary clarifier. The clarified effluent being taken to chemical dose cum clarifier to remove colour Poly Aluminum Chloride is added in chemical dosage tank. The supernatant from tertiary clarifier is being treated through pressure sand filters followed by cartridge filter before feeding to RO .

RO system

Pure salt recovered for reuse in the process

(vi) The unit has two stage RO system, the RO permeate being used in the process, the RO reject is being concentrated through 2 effect falling film & 2 effect of forced circulation evaporator, the temperature of concentrated effluent being reduced to 10-

12ºC to facilitate the crystal formation of sodium salt. After recovering the salt the mother liquor being sent to solar evaporation ponds.

(vii) It is informed that the operating cost of treatment system is around Rs200/m^3.

(viii) The reported steam consumption in MEE is 2 ton/hr .

(xi) Solar evaporation ponds are filled totally with concentrated effluent which also indicates the poor operation and maintenance of ETP.

(xii) During inspection samples being collected at various points of ETP to verify the efficiency of ZLD system, the analysis results are depicted below:

Location of samples collected / **Parameters**	**Raw Effluent**	**Aeration tank**	**Tertiary Clarifier out let**	**RO Permeate**	**RO reject**	**MEE Condensate**	**MEE Concentrate**
pH	9.2	7.0	7.7	6.6	7.8	8.6	8.5
EC (µs/cm)	7710	-	11830	335	-	75	-
TSS (mg/L)	20	-	12	BDL	36	-	-
TDS (mg/L)	5576	-	9490	216	-	60	-
BOD (mg/L)	109	-	3.4	-	-	-	-
COD (mg/L)	320	-	78	BDL	-	-	-
Sulphate (mg/L)	2675	-	4295	-	-	-	-
Chloride (mg/l)	693	-	1600	-	-	-	-
Total Hardness (mg/l)	-	-	304	81	1471	-	-
Total solids (mg/l)	-		-	-	63245	-	259257
MLSS (mg/l)	-	4476	-	-	-	-	-

(x) From the analysis results the RO efficiency is worked about 84.9%. As per analysis results the solid concentration is increased from 6.32 to 25.92% through MEE falling film followed by forced circulation Evaporator. After recovering pure salt the mother liquor is being sent to solar evaporation pond. As per the analysis results the MEE final concentrate which is being sent to solar evaporation is worked about 15 kld.

3.5.5 M/s Poppy Arts Dyeing (P) Ltd

General Information :

Address of the IETP	:	M/s Poppy Arts Dyeung (P) Ltd., Chinnakarai village, Arulpuram, Tipruppur
Production capacity (consented)	:	Dyeing of fabrics --- 225 tons/month
Operating at	:	225t/m or 7.5 tons/day
Installed capacity of IETP in MLD/KLD	:	0.50 MLD or 500 KLD

Operating capacity in MLD	:	0.50 MLD or 500 KLD
Sequences of treatment system exist to achieve ZLD	:	Collection tank, equalization tank, chemical dosage tanks, Primary clarifier, aeration tank, secondary clarifier, chemical dose cum tertiary clarifier, reverse osmosis, followed by MEE and solar evaporation pond.
Quantity of treated effluent recycled in the process	:	90 % of Treated effluent recovered through RO being recycled in process
Type and Quantity of salt recovered per day	:	Sodium sulphate 1.3 tons/day as pure salt
Quantity of salt recycled in the process	:	100%
Quantity of concentrated effluent sent to solar evaporation pond	:	5 kld
Quantity of impure salt generated per day	:	300 kg/ month

Specific Observations:

(i) M/s Poppy Arts Dyeing Process is a textile unit with installed capacity of 7.5 t/d and operating at full capacity.

(ii) The unit is involved in dyeing and washing of yarn & fabric. Sodium sulphate salt is used in the process.

(iii) The unit has established its own ETP of capacity 500 kld and operating at full capacity.

(iv) The effluent of pH 9-10 is received in the receiving tank and treated through to primary clarifier. Sulphuric acid dosing is provided in the out let of receiving tank itself to neutralize the effluent. The clarified effluent from primary clarifier is being treated through biological treatment system followed by secondary clarifier. The clarified effluent being taken to chemical dose cum clarifier to remove colour Poly Aluminum Chloride is added in chemical dosage tank. The supernatant from tertiary clarifier is being treated through pressure sand filters followed by cartridge filter before feeding to RO .

(v) The unit has three stage RO system, the RO permeate being used in the process, the RO reject is being concentrated through 3 effect falling film & 1 effect of forced circulation evaporator, the temperature of concentrated effluent being reduced to 10-12^{o}C to facilitate the crystal formation of sodium salt. After recovering the salt the mother liquor being sent to solar evaporation ponds.

(vi) It is informed that the operating cost of treatment system is around Rs. 150/m^3.

(vii) The reported steam consumption in MEE is 0.75ton/hr .

Raw effluent Collection tank

Filtre press for sludge dewatering

Secured land fills site

Solar evaporation ponds

(viii) The house keeping in the ETP area was found very poor. The chemical dosage practiced also found unscientific way, without any dosage regulation chemicals are added in unskilled manner.

(ix) The operation of RO system and MEE also found not satisfactory.

(x) Solar evaporation ponds are filled totally with concentrated effluent which also indicates the poor operation and maintenance of ETP.

(xi) During inspection samples being collected at various points of ETP to verify the efficiency of ZLD system, the analysis results are depicted below:

Location of samples collected / **Parameters**	**Raw Effluent**	**Aeration tank**	**Tertiary Clarifier out let**	**RO Permeate**	**RO reject**	**MEE Condensate**	**MEE Concentrate**
pH	8.1	7.0	8.1	5.1	8.2	7.5	9.5
EC (µs/cm)	5800	-	6480	83	-	105	-
TSS (mg/L)	92	-	BDL	BDL	44	-	-
TDS (mg/L)	4608	-	5664	42	-	84	-
BOD (mg/L)	366	-	3.0	-	-	-	-

COD (mg/L)	843	-	74	13	-	-	-
Total Hardness (mg/l)	-	-	169	15	1010	-	-
Total solids (mg/l)	-		-	-	41385	-	243004
Fixed solids (mg/l)	-	-	-	-	40291		236580
Volatile solids (mg/l)	-	-	-	-	1095	-	6424
MLSS (mg/l)	-	752	-	-	-	-	-

(xii) From the analysis results the RO efficiency is worked about 86.3%. As per analysis results the solid concentration is increased from 4.13 to 24.3% through MEE falling film followed by forced circulation Evaporator. After recovering pure salt the mother liquor is being sent to solar evaporation pond. As per the analysis results the MEE final concentrate which is being sent to solar evaporation is worked about 9 kld.

3.5.6 M/s Maruthy Dyeing (P) Ltd.,

General Information :

Address of the IETP	:	M/s Maruthy Dyeing (P) Ltd., Periyandipalyampieivu, Kulle Gounden Pudur, Kozhi Pannai Bus Stop, Mangalam Road, Tiruppur.
Production capacity (consented)	:	Dyeing of fabrics --- 1.3 tons/day
Operating at	:	1.3 tons/day
Installed capacity of IETP in MLD/KLD	:	0.10 MLD or 100 KLD
Operating capacity in MLD	:	0.10 MLD or 100 KLD
Sequences of treatment system exist to achieve ZLD	:	Collection tank, equalization tank, Flash mixer, Primary clarifier, aeration tank, secondary clarifier, treated water sump, dual media filter, Activated carbon filter , reverse osmosis, followed by solar evaporation pond.
Quantity of treated effluent recycled in the process	:	95 % of Treated effluent recovered through RO being recycled in process
Type and Quantity of salt recovered per day	:	Sodium chloride as a brine solution
Quantity of salt recycled in the process	:	100%
Quantity of concentrated effluent sent to solar evaporation pond	:	4 kld

Specific Observations:

(i) M/s Maruthy Dyeing (P) Ltd., is a textile unit with installed capacity of 1.3 t/d and operating at full capacity.

(ii) The unit is involved in dyeing and washing of yarn & fabric. Sodium chloride salt is used in the process.

(iii) The unit has established its own ETP of capacity 100 kld and operating at full capacity.

(iv) The effluent is received in the receiving tank and taken to equalization tank, in chemical dosage tank, lime (500 ppm), Ferrous sulphate (350 ppm), poly electrolyte (0.3 ppm) and HCl (200 ppm) are added and treated through primary clarifier. The clarified effluent from primary clarifier is being treated through biological treatment system followed by secondary clarifier. The clarified effluent being taken to chemical dose cum clarifier to remove colour Poly Aluminum Chloride is added in chemical dosage tank. The supernatant from tertiary clarifier is being treated through pressure sand filters followed by cartridge filter before feeding to RO .

(v) It is informed that the operating cost of treatment system is around Rs. 80/m^3.

Poor house keeping in Effluent collection system and in RO system

Solar Evaporation ponds with concentrated effluent

(vi) The unit has four stage RO system, the RO permeate being used in the process, the RO reject is being treated through nano filtration, nano product is being used as brain and reject is being sent to solar evaporation ponds.

(vii) The house keeping in the ETP area was found very poor. The chemical dosage practiced also found unscientific way, without any dosage regulation chemicals are added in unskilled manner.

(viii) The operation of RO system and MEE also found not satisfactory.

(ix) Solar evaporation ponds are filled totally with concentrated effluent which also indicates the poor operation and maintenance of ETP.

(x) During inspection samples being collected at various points of ETP to verify the efficiency of ZLD system, the analysis results are depicted below:

Location of samples collected / **Parameters**	**Raw Effluent**	**Aeration tank**	**Tertiary Clarifier out let/RO feed**	**RO Permeate**	**RO reject**	**Nano product**	**Nano reject**
pH	10.0	7.0	8.7	6.2	7.3	7.2	9.0
EC (µs/cm)	7620	-	6220	175	13800	20600	22500
TSS (mg/L)	64	-	18	-	-	-	-
TDS (mg/L)	4182	-	3716	78	-	14216	-
BOD (mg/L)	302	-	1.2	-	-	-	-
COD (mg/L)	558	-	12.0	3.0	-	-	-
Chloride (mg/l)	-		1505	20.7			-
Sulphate (mg/l)	=		363	0.5			-
Total Hardness (mg/l)	135	-	104	BDL	-	-	-
Total solids (mg/l)	-		-	-	9988	-	16393
Fixed solids (mg/l)	-	-	-	-	9396		15439
Volatile solids (mg/l)	-	-	-	-	592	-	954
MLSS (mg/l)	-	3000	-	-	-	-	-

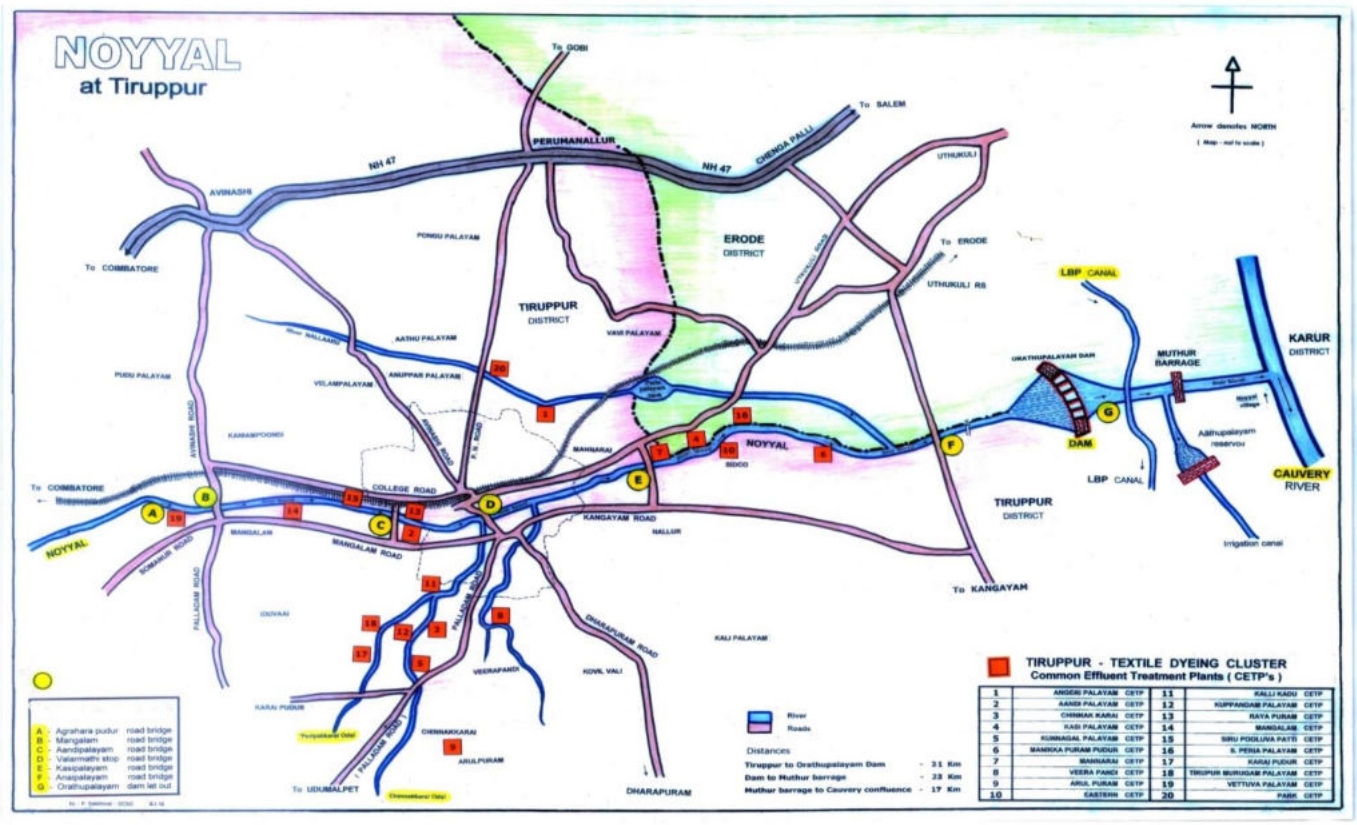
(xi) From the analysis results the RO efficiency is worked about 62.79%. As per analysis results the solid concentration is increased from 0.9 % to 1.6% through Nano and the. same being sent to solar evaporation pond. As per the analysis results the nano reject sent to solar evaporation is worked about 13 kld.

3.6 Assessment of Surface and Ground water monitoring along the River Noyyal at Tiruppur

3.6.1 Surface water monitoring:

The Noyyal river rises from the Vellingiri Hills in the Wester Ghats in Tamilnadu and drains into Kaveri. The river's basin is 180 km long and 25 km wide and covers a total area of 3500 km^2. The Noyyal river passing through Coimbatore district, Tiruppur district and Karur District. Two major dams were constructed in Noyyal river, one is Orathupalyam Dam near Chennimalai, Tiruppur district and other is Aathupalayam Dam near Vallakoil in Karur district. The river has 23 Check dams, most of them are located in between Kooduthurai and Tiruppur. The river was flows with natural antibiotic minerals. The entire Orathuppalayam Dam has become a tank of holding effluent due to discharge of effluent from CETPs & IETPs located in Tiruppur and releases water after every rainfall, which results in polluting the down river villages in the Tiruppur and Karur Districts.

However, 2004 onwards, local volunteers made efforts to conserve the water resources of Noyyal river. After several petitions from 2003 to 2011, dyeing bleaching units (CETP & IETPs) were ordered to close until installation of Zero Liquid Discharge system. The below diagram represents the stretches of Noyyal river passing through Tiruppur and location of CETPs exist along the Noyyal river. It is observed that all CETPs & IETPs are located in between Point A & F.



As a part of the study, surface water sampling was done in Noyyal river to assess the quality of river. The location was selected in consultation with officials of Tamilnadu Pollution Control Board. The analysis results are depicted below;

Location of samples collected / **Parameters**	**U/S of Noyyal river at Agrahara Pudur (A)**	**D/S of Noyyal river at Anaipalyam bridge (F)**
pH	7.5	7.6
EC (µs/cm)	6170	5120
TSS (mg/L)	08	40
TDS (mg/L)	4304	3070
Colour (apparent)	clear	Light yellow
BOD (mg/L)	3.3	13.3
COD (mg/L)	21.7	93.9
Total Hardness (mg/l)	1679	666
Calcium (mg/l)	329	182
Magnesium (mg/l)	209	52
Alkalinity as $CaCO_3$ (mg/l)	312	666
Chloride (mg/l)	1611	1074
Sulphate (mg/l)	576	400
Sodium (mg/l)	635	874
Potassium (mg/l)	32	46
Nitrate as N (mg/l)	0.43	0.23
Nitrite as N (mg/l)	0.56	10.5
Flouride (mg/l)	0.93	0.89

From the analysis results, it is observed that TDS, total Hardness, calcium, magnesium, chloride and sulphate concentration at upper stream (u/s) of Noyyal river was found higher than the downstream (d/s) stream of river, this may be due to accumulation of old sediment or due to discharge of industrial effluent. Though, the concentration of above mentioned parameter found lesser than the u/s, the river water quality is found poorer than the domestic effluent w.r.t TDS, Chloride and Sulphate.

Sample collected at U/S of Noyyal river at Agrahar Pudur

Sample collected at D/S of Noyyal river at Anaipalyam bridge

3.6.2 Ground water monitoring:

As a part of the study, ground water sampling was done along the Noyyal river to assess the quality of ground water. The location was selected in consultation with officials of Tamilnadu Pollution Control Board, during monitoring 10 ground water samples viz., 1. Bore well (Sh. Murugasamy) at Kashipalayam, 2. Bore well (M/s Texwell industries) at kasha palyam, 3. Open well at Uthukulli/Kageyam road, 4. Open well near Anaipalyam road bridge, 5,Open well at Vaykkal thottam, 6. Bore well near M/s PRK sizing mill, Vayakkadu thottam, 7. Open well at Mangalam, 8. Open well at Korikkadu near mangalam road bridge, 9. Open well at Perumal thottam, Kavalipalayam, Pudur and 10. Open well at Brindavan residential area. The analysis results are depicted below;

Location of samples collected / **Parameters**	**Bore well - 1**	**Bore well - 2**	**Open well -3**	**Open well - 4**	**Open well -5**	**Bore well - 6**	**Open well - 7**	**Open well -8**	**Open well - 9**	**Open well - 10**
pH	7.8	7.3	7.5	7.6	6.9	7.1	6.6.	6.7	6.8	7.6
EC (µs/cm)	1230	4590	4220	7750	10040	6630	12110	13280	12050	2760
TDS (mg/L)	782	2836	2548	4828	7246	3750	9138	9708	8226	1704
Colour (apparent)	clear	clear	clear	clear	clear	clear	clear	clear	clear	clear
Total Hardness (mg/l)	417	733	589	802	3435	1805	4883	3976	4092	753
Calcium (mg/l)	120	201	170	205	658	371	990	766	797	259
Magnesium (mg/l)	28.6	56.3	39.9	70.3	439	213	586	502	511	26
Alkalinity as $CaCO_3$ (mg/l)	256	508	580	442	324	388	256	340	292	436

Chloride (mg/l)	168	838	860	1782	2897	1725	3637	3972	3775	444
Sulphate (mg/l)	29.1	608.4	300.6	78.2	970	497	1173	1237	590	120
Sodium (mg/l)	58	772	743	1436	1905	1695	1980	3370	2755	509
Potassium (mg/l)	43	16	21	18.5	58	43	75	200	105	127
Nitrate as N (mg/l)	10.1	6.05	4.8	7.0	3.26	5.52	15.1	6.4	31.04	26.7
Nitrite as N (mg/l)	0.5	0.2	0.03	0.47	0.26	0.47	0.63	0.26	0.18	0.6
Fluoride (mg/l)	0.77	1.51	1.3	1.12	1.19	1.38	0.89	1.20	1.45	1.36

From the analysis results, it is observed that except bore well no. 1 and open well no 10, the TDS, Chloride, Sulphate and Sodium concentration found very high which reveals that contamination of ground water due to discharge of untreated/partially treated effluent into land/drain in the past. These ground water is not meeting the irrigation water quality (w.r.t TDS, Chloride, sulphate and sodium) criteria also.

Open wells and Bore wells in which ground water samples taken during monitroing

Chapter 4.0
Results and Discussion

4.0 Results and Discussion

The Textile dyeing units who are having their individual ETP and member units of CETPs in Tirupur have implemented ZLD by installing Treatment facilities comprises of Physico-Chemical followed by Biological treatment followed by combination of Nano filtration, Reverse Osmosis process to recover permeate and brine solution which can be recycled in the process. For RO reject management the IETPs and CETPs installed combination of Mechanical Vapour Recompressor (MVR), MEE (Multiple Effect falling film /forced circulation Evaporator) and crystallizer to recover pure salt upto maximum extent. The CETPs and IETPs claims that no effluent being discharge into drain/surface water. Based on the study carried out in IETPs and CETPs of Tirupur by the CPCB team, following results and discussion are arrived.

4.1 Water recovery and reuse

CETPs and IETPs are recovering the water from treated effluent through RO system and the same being used in their process which results reduction of fresh water consumption in dyeing process. The details of RO permeate recovery is as below;

In CETPs :

Name of the CETP **Details of recovery system**	**CETP -1**	**CETP -2**	**CETP -3**	**CETP - 5**	**CETP - 6**	**CETP - 7**	**CETP - 8**	**CETP - 9**
Operating Capacity in kld	1350	1300	2500	3850	1400	1500	2200	900
Stages of RO system	4 stages	4 stages	3 stages	4 stages	3 stages	3 stage	4stages	4 stages
Efficiency as per monitoring	77.6%	70.11%	83.9 %	64 %	90%	77.6%	78.4%	75%
RO permeate recovered in kld	1047.6	911.43	2097.5	2464	1260	1164	1724.8	675

In IETPs :

Name of the IETP **Details of recovery system**	**IETP -1**	**IETP -2**	**IETP -3**	**IETP -4**	**IETP -5**	**IETP -6**
Operating Capacity in kld	650	1500	1150	800	500	100
Stages of RO system	3 stages	4 stages	3 stages	2 stages	3 stages	4 stage

Efficiency as per monitoring	89.9 %	46.4 %	55 %	84.9 %	86.3%	62.79%
RO permeate recovered in kld	584.35	696	632.5	679.2	431.5	62.79

From the above tables it is observed that all CETPs and IETPs monitored have installed RO with 3 or 4 stages and achieving minimum of 64 % & maximum of 90 % efficiency in CETPs and minimum of 46.4% & maximum of 89.9% efficiency in IETPs. The efficiency of RO depends on the good practises adopted before feeding to RO system. It is also observed that all CETPs and IETPs are using these RO permeate in their process and reduced proportionate quantity of fresh water consumption in their process.

4.2 RO reject management

The RO reject from RO system is further concentrated through combination of MVR/ MEE (falling film, forced circulation evaporator)/ crystallisation/centrifuge and recovering either in the form of pure salt or in the form of brine solution which is being used in the dyeing process of their own unit or in their member units. The details of reject management system installed in different CETPs/IETP are as follows;

In CETPs :

Name of the CETP **Details of reject management system**	**CETP -1**	**CETP -2**	**CETP -3**	**CETP - 5**	**CETP - 6**	**CETP - 7**	**CETP - 8**	**CETP - 9**
Solid Concn in RO reject	4.4%	3.68%	6.68%	1.18%	5.97%	4.36%	3.9%	4.8%
Nano filtration	yes	no	no	no	yes	no	no	no
Solid concentration achieved through MVR	5.9%	9.51%	10.9%	13.0%	no	11.70%	9.4%	10.59%
MEE falling/forced circulation with number of effects and solid concentration achieved	4 effect	5 effects	5 effects	8 effects	5 effects	4 effects	3effects	Not exist
	27.7%	18.03%	43.4 & 48.3%	78.18%	20.16%	22.5%	30.85	

In IETPs :

Name of the IETP **Details of reject management system**	**IETP -1**	**IETP -2**	**IETP -3**	**IETP -4**	**IETP -5**	**IETP -6**
Solid Concn in RO reject	3.79%	0.71%	1.17%	6.32%	4.13	0.9
Nano filtration	no	no	no	no	no	yes

Solid concentration achieved through MVR	-	-	-	-	-	-
MEE falling/forced circulation with number of effects and solid concentration achieved	5 effect	8 effects	5 effects	4 effects	5 effects	Not exist
	38.61%	26% & 29.8%	27 & 45.98%	25.92	24.3	

From the above table it reveals that CETPs installed MVR system are found achieving solid concentration in the range of 5.9 to 11.70 % and further concentrated through Multi Effect Evaporator and achieving solid concentration in the range of 18.03 – 48..3 %. However one CETP found achieving solid concentration of 78.18 % through 8 effect MEE. All IETPs are found achieving solid concentration in the range of 24..3 to 45.98 % through only MEEs .

After concentration through different technologies CETPs/IETPS found recovering either pure salt or in terms of brine solution and using the same in their own unit or in their member units. The condensate generated during concentration is being mixed with RO permeate and used in the process. However still 5- 31 % of concentrated effluent having 30-35% TDS concentration being sent to solar evaporation ponds. No CETPs or IETPs are practising 100% salt recovery through advanced concentration techniques. This process is energy intensive but necessary to meet the zero liquid discharge requirements.

4.3 Salt recovered in terms of Pure salt, brine solution and impure salt

During study, samples were taken at different points of treatment facilities to verify the efficiency of ZLD system installed to achieve zero discharge. Below table shows the efficiency of ZLD system installed in different CETPs and IETPs;

In CETPs :

Name of the CETP / **Details of acheivability**	**CETP -1**	**CETP -2**	**CETP -3**	**CETP -5**	**CETP -6**	**CETP -7**	**CETP -8**	**CETP -9**
Salt(based on TDS) entered into CETPs	11.3 t/d	12.8 t/d	21.2 t/d	16.17t/d	8.68 t/d	15.41t/d	17.3t/d	11.9t/d
Pure salt recovered in terms of Sodium sulphate or sodium chloride	-	-	6 t/d	12.5t/d	-	4 t/d	no	no
Quantity of salt	8.64t/d	8.58 t/d	-		7.73t/d		10.64t/d	2.96 t/d

recovered in terms of brine solution.								
Quantity of concentrated effluent sent to solar evaporation	16 kld (5.3%)	35.9 kld (9.2%)	40 kld (9.9%)	9kld (0.65%)	4kld (2.85%)	40 kld (11.9%)	25kld (5.26%)	70kld (31.1%)
Impure salt recovered from solar pond	1.7 t/d	1.857 t/d	1.5 t/d	3.2t/d	0.102t/d	-	-	-
Efficiency w.r.t salt recovery	91.5%	81.53%	35.3%	97.5%	90.2%	25.9%	61.5%	24.8%

In IETPs :

Name of the IETP **Details of achievability**	**IETP -1**	**IETP -2**	**IETP -3**	**IETP -4**	**IETP -5**	**IETP -6**
Salt(based on TDS) entered into CETPt	1.64 t/d	4.94 t/d	3.68 t/d	4.46t/d	2.3 t/d	0.418t/d
Pure salt recovered in terms of Sodium sulphate or sodium chloride	1.23t/d	-	3.0 t/d	2t/d	1.3t/d	-
Quantity of salt recovered in terms of brine solution.	-	1.3t/d	-	-	-	0.26t/d
Quantity of concentrated effluent sent to solar pond	4.5 kld (6.85%)	3.85kld (0.45%)	10kld (1.9%)	15kld (12.4%)	9kld (13.13%)	13 kld (34.9%)
Efficiency w.r.t salt recovery	87.19%	36.73%	95.1%	45.08%	56.66%	62.22%

From the above table it is observed that all CETPs and IETPs are still sending 5- 31% of concentrated effluent into solar ponds for natural evaporation. Only 3 CETPs found achieving >90% efficiency w.r.t salt recovery and 2 IETPS found achieving >85% efficiency w.r.t salt recovery.

4.4 ETP Sludge management

Main sources of sludge generation is chemical treatment system and biological treatment system, It was observed that no CETPs/ IETPs are found not maintain any records about sludge generation. However the sludge being stored separately and the chemical sludge having lime content are being sent to cement industries for co-processing. The CETPs/IETPs handling combined sludge from chemical and biological system are facing problem of disposal of sludge.

4.5 Conclusions and Recommendations/suggestions:

4.5.1 Conclusions

- In Tirupur there are 20 CETPs and 39 IETPs are exist, during study period 17 CETPs and 37 IETPS were found in operation at restricted capacity based on the treatment facility available to achieve ZLD.
- All CETPs/IETPs are achieving prescribed standards of TNPCB w.r.t pH, BOD, COD, TSS through physico- chemical followed by biological treatment.
- As per the study, RO efficiency was found wide variation, only one CETP was found achieving 90 % efficiency. The CETP/IETPs who have taken measures to reduce hardness and microbial fouling before feeding to RO system found achieving efficiency in the range of 75- 85%.
- Through MVR technology, the solid concentration in RO reject was found increased maximum of 11-12 % only.
- All CETPs/IETPs found installed MEE with minimum of 3 effects and maximum of 5-8 effects and achieving solid concentration in the range of 18-48%. The CETP/IETPs who have taken measures to reduce hardness < 50 mg/l before feeding to MVR/MEE found achieving good solid concentration and recovering pure salt in the range of 85-95%.
- Some of the CETP's are sending partially concentrated brine to their member units through tanker and some of CETP's are recovering the pure salt after concentrations.
- Pure salt recovered from the RO reject is being utilised in the process and impure salt recovered is stored under shed
- NO CETPs/IETPS found achieving 100 % ZLD system, still concentrated effluent in the range of 5-31% of concentrated effluent having 30-35% TDS concentration being sent to solar ponds for natural evaporation.
- All CETPs/IETPs are found installed online flow measuring system and the same being connected to TNPCB CARE AIR centre.
- No CETPs/IETPs found not maintaining the records of biological/ chemical sludge generated.
- Most of the CETPs/IETPs are not taken any steps to identify the proper storage place to store impure salt generated from solar ponds.

- All CETPs and IETPs are storing huge quantity of chemical sludge generated from ETPs.
- As per monitoring of CPCB, Noyyal river water quality is found poor due to accumulation of old sediment or due to discharge of industrial effluent.
- The TDS, Chloride, Sulphate and Sodium concentration found very high in the ground water samples taken along the Noyyal River. This ground water is not meeting the irrigation water quality (w.r.t TDS, Chloride, Sulphate and Sodium) criteria also.

4.5.2 Recommendations/Suggestions

Tamil Nadu State Pollution Control Board may be asked to implement the following recommendations/suggestions to control the pollution load from CETPs/IETPs to stop further pollution of Noyyal River & ground water in Tirupur.

- To monitor drains joining to the Noyyal River to trace any illegal discharge of effluent from any industries.
- To take steps for ground water remedial measures through recognised institutions/organisation to reclaim the ground water quality along the Noyyal river as well as in Tirupur.
- To ask CETPs/ IETPS to take measures to improve efficiency of RO, MEE to achieve 100 % ZLD.
- To ask CETPs/IETPs to maintain proper records of Sludge generated and disposed.
- To ask CETPs/IETPs to store impure salt in the designated place by covering properly.
- To take up study to explore utilisation of impure salt in other industrial sector as auxiliary raw material.

	QUESTIONNAIRE FOR COMMON EFFLUENT TREATMENT PLANTS OF TEXTILE DYING UNITS LOCATED IN TIRUPUR	**SOUTH ZONAL OFFICE, Bengaluru**

Annexure -1

1. Name/ address of CETP/ company: ----------

2. Contact person (Name, Designation, and Contact No.): ----------

3. Status of the CETP: Operational or Closed

4. Consent status : Valid up to

: Applied (Date of Application)

5. Industrial area (s) connected to the CETP: ----------

6. Details member units of CETP

Name of member units	**Production capacity**	**Total Water consumption per tone of production(m^3/ton)**		**Effluent generation per ton of production**	**Type of Salt consumption per ton of production**
		Fresh water consumption (m^3/ton)	**RO permeate consumption (m^3/ton)**		

7. Treatment capacity ----- MLD / Design flow of CETP: (-------m^3/hr)

8. Wastewater treated: ---------- MLD/ Average flow reaching CETP (------ m^3/hr)

9. Wastewater bypassed: ---------- MLD

10. Method of collection of effluent (pipeline/tanker):

- If collection is by tankers, average No. of tankers/day:----------
- Capacity of tankers, m^3:----------

11. Details of instrumentation/meters:(type, location and operational status)

Flow/ Volume and quality of untapped Wastewater:

Industrial area	Drain carrying untapped flow	Quality of untapped Wastewater in drain	Approx. Flow/Volume

12. Treatment Scheme:

a) Conventional system (physico-chemical and biological treatment)
b) Conventional with tertiary system (pressure filtration, activated carbon, additional physico-chemical treatment)
c) Additional treatment (Multi-effective evaporator, RO, advanced oxidation process)

Unit sizes of main treatment units and operational conditions:

Treatment unit	Collected information
Receiving tank	Hourly influent flow rate, m^3/h: Volume of tank, m^3:
Equalization tank	Hourly influent flow rate, m^3/h: Volume of tank, m^3:
Flocculation tank	Hourly influent flow rate, m^3/h: Volume, m^3:
Tube settler*	Hourly influent flow rate--------- m^3/h Total number of operation hours: Surface area, m^2: Media depth, m: Effective surface area, m^2 / m^3 media:
Primary settling tank*	Hourly influent flow rate, m^3/h: Surface area, $m^{2:}$ or diameter, m:
Up flow Anaerobic Sludge Blanket Reactor	Hourly influent flow rate, m^3/h: Volume of tank, m^3: Sludge wasting rate, m^3/day:
Aeration tank	Hourly influent flow rate, m^3/h: Volume of tank, m^3: No. of aerators: Capacity of each aerator, HP:
Secondary settling tank	Hourly influent flow rate, m^3/h: Surface area, $m^{2:}$ or diameter, m:
Colour removing treatment	Hourly influent flow rate, m^3/h: Chemical dosage given in PPM: Residential time in minutes: Volume of tanks in m^3
Dual media filters	Total units: and diameter of each unit, m: Hourly influent flow rate, m^3/h: Operation hours/day: -

	No of units used:
Activated carbon columns	Total units: and diameter of each unit, m: Hourly influent flow rate, m^3/h: Operation hours/day: No of units used:
Sludge thickener	Daily & Hourly primary sludge flow rates, m^3/h: Operation hours: Surface area, $m^{2:}$ or diameter, m:
Rotary vacuum filter	Daily & Hourly thickened sludge flow rates, m^3/h: (Thickened sludge pump cap.: -------m^3/hr) Operation hours/day: Dia, m: , Cloth width, m: , RPM: Design loading, kg/m^2/h:
Sludge Drying Beds	• Capacity of Sludge Drying Bed – Kg/Tonnes • Minimum Retention Period • Size of Sludge Drying Bed –Length, Breadth, Width

(*A CETP either has Primary settling tank or Tube Settlers for removal of suspended/ dissolved solids)

- Aeration Tank: MLSS:--------mg/l
  MLVSS: ------mg/l
  DO: ----------mg/l
  - Chemical dozing:
    Sodium sulphate ------ ppm,
    Alum ---------ppm,
    Poly-electrolyte ------ppm

  - Method of regulating and measuring primary sludge withdrawal flow rate:
  - Method of regulating / measuring thickened sludge withdrawal flow rate:
  - Results of analysis of samples after different stages of treatment:

General parameters: All values in mg/L except pH

Sample point	pH	BOD	COD	TSS	TDS
Raw effluent or Before equalization					
After equalization					
After Up flow Anaerobic Sludge Blanket Reactor (VSS also)					
After Tube settler /PST					
Aeration tank mixed liquor (TSS & VSS only)					
After SST					
After dual media filters					
After activated carbon columns					
Tube settler /PST sludge (underflow and TSS only)					
Thickener sludge (underflow and TSS only)					

SST return / excess sludge (TSS only)					
Discharge Standards(limits)					

Design parameters & monitoring

Parameter	Inlet quality	Outlet quality	Limits(standards)
P^H			
BOD			
COD			
TDS			
Chlorides			
Sulphates			
SS			

Metals and special parameters: All values in mg/L except %Na and SAR

Sample point	Cd	Cr	Cu	Fe	Ni	Pb	Zn
Before equalization							
PST sludge (underflow)							
Thickener sludge (underflow)							
After activated carbon columns							

13. Method of Waste water collection: Tankers / Industrial sewers / Drains

1. Primary Sludge Management System:

Primary Sludge generation rate (m^3/ day or tons/ day):
Number and capacity of sludge drying beds:
Quantity of sludge stored:
Primary Sludge Disposal* (Secured Land Fill or TSDF):
(*Co-incineration if any)

2. Excess Biological Sludge Management System:

Excess Biological Sludge generation rate:
Number and capacity of sludge drying beds:
Quantity of sludge stored:
Excess Biological Sludge Disposal:

3. Details of any other methods for sludge thickening (filter press/rotary filters etc.)

4. Zero Liquid Discharge: Yes or No (If yes, then provide details of technology, water/ salt reuse)

Capacity of RO in KLD	**Feed rate of RO in m^3/hr**	**RO permeate Recovery in m^3/hr**	**RO reject generated in m^3/hr**	**Solid concentration of RO reject in**

				mg/l

5. Reject Management System:

Solar Evaporation Ponds/ Mechanical Effect Evaporator*/ Mechanical Vapor Recompression*

Type of evaporator with no. of effects	**Feed rate i m^3/hr**	**Solid concentration of MEE feed in mg/l**	**Steam feed rate in ton/hr**	**Quantity of condensate generate in m^3/hr**	**Quantity of salt generate**		**Quantity of mother liquor sent to solar evaporation pond in m^3/day**
					Pure salt in tons/day	**Impure salt in tonnes per day**	

Residue Disposal (Secured Land Fill facility/ TSDF)

*Fuel used for making steam: Wood/ Rice Husk/Coal

*Air Pollution Control Device used

6. Conveyance system for disposal of treated wastewater: Drains/ Pipeline

7. Method of Treated wastewater recycle/disposal: Reuse in member units /River/ Land/ Marine

8. Recovery: infrastructure for supply of recovered water
Salts recovered:

9. Hazardous Substances Handling :

Name of Chemicals	Storage Capacity	Threshold Capacity

Any Treatment Storage and disposal facility for hazardous waste (TSD) (Yes or No):

10. Operational Cost:

11. Other observations:

Inspected by (Name & Designation):

	QUESTIONNAIRE FOR INDIVIDUAL EFFLUENT TREATMENT PLANTS OF TEXTILE DYING UNITS LOCATED IN TIRUPUR	**SOUTH ZONAL OFFICE, Bengaluru**

1. Name/ address of IETP/ company: ----------

2. Contact person (Name, Designation, and Contact No.): ----------

3. Installed Capacity of Unit ----------
4. Present operating Capacity of the unit ----------
5. Status of the IETP: Operational or Closed
6. Consent status : Valid up to

   : Applied (Date of Application)

7. Details of raw material used ----------
8. Details of chemical used per ton of fabric ----------

Sl. No.	**Name of the chemicals, bleaching agents and dyestuff**	**Composition of chemical**	**Quantity of chemicals used per ton of fabrics**
1			
2			
3			

9. Details of salts used per ton of fabric ----------

Sl. No.	**Name of the salt**	**Quantity of salt used per ton of fabrics**		**Quantity of Brain solution used per ton of fabric**
		Fresh salt consumption	**Recovered salt consumption**	
1				
2				
3				

10. Total Water consumption per tonne of production in **m^3/ton** ----------
    a. Fresh water Consumption in **m^3/ton** ----------
    b. RO permeate/ MEE condensate consumption in **m^3/ton** ----------

11. Treatment capacity ----- MLD / Design flow of IETP: (-------m^3/hr)

12. Wastewater treated: ---------- MLD/ Average flow reaching IETP (------ m^3/hr)

13. Wastewater bypassed: ---------- MLD

14. Method of collection of effluent (pipeline/tanker):

- If collection is by tankers, average No. of tankers/day:----------
- Capacity of tankers, m^3:----------

15. Details of instrumentation/meters:(type, location and operational status)

Flow/ Volume and quality of untapped Wastewater:

16. Treatment Scheme:

d) Conventional system (physico-chemical and biological treatment)
e) Conventional with tertiary system (pressure filtration, activated carbon, additional physico-chemical treatment)
f) Additional treatment (Multi-effective evaporator, RO, advanced oxidation process)

Unit sizes of main treatment units and operational conditions:

Treatment unit	Collected information
Receiving tank	Hourly influent flow rate, m^3/h: Volume of tank, m^3:
Equalization tank	Hourly influent flow rate, m^3/h: Volume of tank, m^3:
Flocculation tank	Hourly influent flow rate, m^3/h: Volume, m^3:
Tube settler*	Hourly influent flow rate--------- m^3/h Total number of operation hours: Surface area, m^2: Media depth, m: Effective surface area, m^2 / m^3 media:
Primary settling tank*	Hourly influent flow rate, m^3/h: Surface area, $m^{2:}$ or diameter, m:
Up flow Anaerobic Sludge Blanket Reactor	Hourly influent flow rate, m^3/h: Volume of tank, m^3: Sludge wasting rate, m^3/day:
Aeration tank	Hourly influent flow rate, m^3/h: Volume of tank, m^3: No. of aerators: Capacity of each aerator, HP:
Secondary settling	Hourly influent flow rate, m^3/h:

tank	Surface area, $m^{2:}$ or diameter, m:
Colour removing treatment	Hourly influent flow rate, m^3/h: Chemical dosage given in PPM: Residential time in minutes: Volume of tanks in m^3
Dual media filters	Total units: and diameter of each unit, m: Hourly influent flow rate, m^3/h: Operation hours/day: - No of units used:
Activated carbon columns	Total units: and diameter of each unit, m: Hourly influent flow rate, m^3/h: Operation hours/day: No of units used:
Sludge thickener	Daily & Hourly primary sludge flow rates, m^3/h: Operation hours: Surface area, $m^{2:}$ or diameter, m:
Rotary vacuum filter	Daily & Hourly thickened sludge flow rates, m^3/h: (Thickened sludge pump cap.: -------m^3/hr) Operation hours/day: Dia, m: , Cloth width, m: , RPM: Design loading, kg/m^2/h:
Sludge Drying Beds	• Capacity of Sludge Drying Bed – Kg/Tonnes • Minimum Retention Period • Size of Sludge Drying Bed –Length, Breadth, Width

(*A IETP either has Primary settling tank or Tube Settlers for removal of suspended/ dissolved solids)

- Aeration Tank: MLSS:--------mg/l
  MLVSS: ------mg/l
  DO: ----------mg/l
  - Chemical dozing:
    Sodium sulphate ------ ppm,
    Alum ---------ppm,
    Poly-electrolyte ------ppm

  - Method of regulating and measuring primary sludge withdrawal flow rate:

  - Method of regulating / measuring thickened sludge withdrawal flow rate:

  - Results of analysis of samples after different stages of treatment:

General parameters: All values in mg/L except pH

Sample point	pH	BOD	COD	TSS	TDS
Raw effluent or Before equalization					
After equalization					
After Up flow Anaerobic Sludge Blanket Reactor (VSS also)					

After Tube settler /PST					
Aeration tank mixed liquor (TSS & VSS only)					
After SST					
After dual media filters					
After activated carbon columns					
Tube settler /PST sludge (underflow and TSS only)					
Thickener sludge (underflow and TSS only)					
SST return / excess sludge (TSS only)					
Discharge Standards(limits)					

Design parameters & monitoring

Parameter	Inlet quality	Outlet quality	Limits(standards)
P^H			
BOD			
COD			
TDS			
Chlorides			
Sulphates			
SS			

Metals and special parameters: All values in mg/L except %Na and SAR

Sample point	Cd	Cr	Cu	Fe	Ni	Pb	Zn
Before equalization							
PST sludge (underflow)							
Thickener sludge (underflow)							
After activated carbon columns							

17. Method of Waste water collection: Tankers / Industrial sewers / Drains

18. Primary Sludge Management System:

Primary Sludge generation rate (m^3/ day or tons/ day):

Number and capacity of sludge drying beds:

Quantity of sludge stored:

Primary Sludge Disposal* (Secured Land Fill or TSDF):
(*Co-incineration if any)

19. Excess Biological Sludge Management System:

Excess Biological Sludge generation rate:

Number and capacity of sludge drying beds:

Quantity of sludge stored:

Excess Biological Sludge Disposal:

20. Details of any other methods for sludge thickening (filter press/rotary filters etc.)

21. Zero Liquid Discharge: Yes or No (If yes, then provide details of technology, water/ salt reuse)

Capacity of RO in KLD	**Feed rate of RO in m^3/hr**	**RO permeate Recovery in m^3/hr**	**RO reject generated in m^3/hr**	**Solid concentration of RO reject in mg/l**

22. Reject Management System:

Solar Evaporation Ponds/ Mechanical Effect Evaporator*/ Mechanical Vapor Recompression*

Type of evaporator with no. of effects	**Feed rate m^3/hr**	**Solid concentration of MEE feed in mg/l**	**Steam feed rate in ton/hr**	**Quantity of condensate generate in m^3/hr**	**Quantity of salt generate**		**Quantity of mother liquor sent to solar evaporation pond in m^3/day**
					Pure salt in tons/day	**Impure salt in tonnes per day**	

Residue Disposal (Secured Land Fill facility/ TSDF)

*Fuel used for making steam: Wood/ Rice Husk/Coal

*Air Pollution Control Device used

23. Conveyance system for disposal of treated wastewater: Drains/ Pipeline

24. Method of Treated wastewater recycle/disposal: Reuse in member units /River/ Land/ Marine

25. Recovery: infrastructure for supply of recovered water

Salts recovered:

26. Hazardous Substances Handling :

Name of Chemicals	Storage Capacity	Threshold Capacity

Any Treatment Storage and disposal facility for hazardous waste (TSD) (Yes or No):

27. Operational Cost:

28. Other observations:

Inspected by (Name & Designation):

Annexure 2

Water consumption and salt consumption in CETPS

sl.no	Name of CETP	No. of member units	Total production capacity by member units	Total water consumption per ton of production Cu.m/T		Wastewater generated (Cu.m/T)	Type of salt used	Salt consumption (kg)
				Fresh water consumption	Recovered water			
1	M/s Arulpuram CETP	14	8253 kg/day	277	5228	5500	Sodium sulphate	33,810
2	M/s Tirupur Murugampalayam CETP	67	72,604 kg/day	559	10,460	48,399	Sodium sulphate	70,309
3	M/s Kasipalayam CETP	12	117.63T/d	42	483	525.4	Sodium sulphate	4000
4	M/s Rayapuram CETP	10	5469kg/d	189	3465	3645	Sodium Sulphate	25,503

Water and Salt recovery in CETPs

sl.no	Name of CETP	Total wastewater Treated (MLD)	Total Treatment capacity (MLD)	Method of collection	Total quantity of permeate recovered	Salt recovered and used	
					cu.m	**Pure salt(T/d)**	**Brine**
1	M/s Arulpuram CETP	2.75	5.5	PIPELINE	5228	-	17.5
2	M/s Tirupur Murugampalayam CETP	1.65	11	PIPELINE	10,460	-	5.76
3	M/s Kasipalayam CETP	1.32	4.4	PIPELINE	483m3/T	1.3	-
4	M/s Rayapuram CETP	1.3	5.5	PIPELINE	3465	-	13

Sludge and mixed salt generation in CETPS

sl.no	Name of CETP	Biological sludge			Chemical sludge			mixed salt			Operation Cost		
		Total quantity	Mode of disposal	Rate	Total quantity	Mode of disposal	Rate	Total quantity	Mode of disposal	Rate	Total quantity	Mode of disposal	Operation cost(rs/KLD)
1	M/s Arulpuram CETP	NA	NA	350kg/d	450T	TSDF	400Kg/d	450T	M/s. Ultratech cement	3.2T/d	1100T	TSDF	260
2	M/s Tirupur Murugampalayam CETP	NA	NA	110KLD	1500kg	TSDF	NA	NA	NA	1.26T/D		TSDF	280
3	M/s Kasipalayam CETP	NA	NA	0.12T/d		Stored in Unit premises	NA	NA	NA			TSDF	280
4	M/s Rayapuram CETP	NA	NA	164	161	TSDF	400kg/d	89T	M/s. Dalmia cement	1.85T/d	960T	TSDF	303

Water consumption and salt consumption and recovery in IETPS

sl.no	Name of CETP	Total water consumption per ton of production Cu.m/T		Type of salt used	Salt consumption (kg)	Total wastewater Treated (MLD)	Total Treatment capacity (MLD)	Method of collection	Total quantity of permeate recovered	Salt recovered and used	
		Fresh water consumption	Recovered water						cu.m	Pure salt(T/d)	Brine
1	M/s Scotts garments Ltd.(Dyeing unit)II	35	150	Sodium sulphate	0.36	0.7	0.7	PIPELINE	150m3/T	0.7	
2	M/s Royal Classic Mills IETP	5	45	Sodium Chloride	0.01	3	4	PIPELINE	45m3/T		

Sludge and mixed salt generation in IETPS

sl.no	Name of CETP	Primary sludge			Biological sludge			Chemical sludge			mixed salt			Operation Cost
		Generatio rate(kg)	Total quantity	Mode of disposal	Rate	Total quantity	Mode of disposal	Rate	Total quantity	Mode of disposal	Rate	Total quantity	Mode of disposal	Operation cost(rs/KLD)
1	M/s Scotts garments Ltd.(Dyeing unit)II	0.20T/day	125T	Secure Landfill	0.07T/d	--	Secure landfill	NA	NA	NA	0.1T/d		Secure land	
2	M/s Royal Classic Mills IETP	10m3/d	2026 T	Secure Landfill	NA	NA	NA	NA	NA	NA				350