Treatment of Woven Fabric Dyeing Wastewater and Reuse by Reverse Osmosis Process

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Abstract:
Textile dyeing industries in Erode and Tirupur district of Tamilnadu (India) discharge effluents ranging between 100 and 200 m³/t of production. Dyeing is performed by Jigger or advanced Soft Flow reactor process. Coloring of hosiery fabric takes place in the presence of high concentration of sodium sulphate or sodium chloride (30 – 75 kg/m³) in dye solutions. Wash water and dye bath waste water are the process effluents of dyeing industry which are collected separately and follow the advanced treatment for maximum recycling of recovered waters. Wash water is treated using a sequence of physicochemical and biological unit process, the waste water is passed into ultra filtration (UF), two stages reverse osmosis (RO) membrane system where the permeate is reused for processes. The rejects about 10 – 12 % of the inlet volume is subject to reverse osmosis for sent to evaporators. Dye bath water after treating, the permeate is used in process for dye bath preparation and the reject of about 20 – 25% is sent to multi effect evaporator / solar evaporation pond (SEP). The final rejects from reverse osmosis system is directed to multi effect evaporator system where condensed waters are recovered. The removal of Total Dissolved Solids (TDS), Chemical Oxygen Demand (COD) and Chloride are in the range of 82 – 97%, 90 – 97% and 78 – 97% respectively.

Keywords: Textile effluent - Recycling wastewater - Reverse osmosis – PH - COD

I. INTRODUCTION
The second basic needs of man ‘cloth’ are supplied by processing of natural and man-made fibres in the textile industries. Increasing population and modernized civilization trend gave rise to booming of textile sectors in India. An estimate shows that textiles account for 14% of India’s industrial production and around 27% of its export earnings. India is the second largest export of cotton yarn. There are about 10,000 garment manufacturers and 2200 bleaching and dyeing industries in India. Majority are concentrated at Erode and Tirupur district of Tamil Nadu, Surat in Gujarat and Ludiyana in Punjab. Erode and Tirupur district at least having 50% of dyeing and bleaching industries where in 30% industries are attached to CETP. Dyeing is a combined process of bleaching and coloring, which generates voluminous quantities of wastewaters and in turn causes environmental degradation. These effluents consist of high TDS, chloride, sulphate, hardness and carcinogenic dye ingredients.

II. OVERVIEW OF COMMON EFFLUENT TREATMENT PLANT
Textile is a major source of income and of great importance for India's economy. At the same time textile processing has major environmental impact. A large proportion of the environmental issues are related to the use and discharge of water. Textile manufacturing is among the major industrial water users. To produce one kg of textile fabrication about 200 liters of water is used. A lot of chemicals are added to the process for cleaning and dyeing purposes. Obviously the wastewater effluent from this unit contains considerable amounts of hazardous pollutants, and where heavy metals are very common. In India most of the effluent from the textile industry is discharged untreated into rivers. Today 70% of available water in India is polluted and two thirds of illness in India is related to water-borne diseases. Water treatment is a very important step to change these conditions and to achieve a sustainable situation. India's government has an awareness of this and limits for water effluent quality exist. Unfortunately, this regulation is not closely supervised and a lot of places do not follow the regulation. In newly developed industrial areas advanced wastewater treatment is used for textile effluent.

III. SIPCOT
The government is promoting industrial growth in backward and hitherto underdeveloped areas that have potential to grow. SIPCOT is an organization arranging this in the state of Tamil Nadu. Companies, willing to start up industries in that area, lease the land for 99 years and are guaranteed good infrastructure, electricity, sewage and water supply 24 hours a day.
IV. SIPCOT PERUNDHURAI

SIPCOT Perundurai was started in the year 2000 and it is divided into two parts, the east and the west part, totally 1240 ha. SIPCOT only leases 732 ha of the total area and today 288 ha of the area is licensed. Currently 210 industries are located in the area within the fields of chemicals, textiles industries, food manufacturing, tanning and engineering products. SIPCOT has a common sewage plant, where black water from all industries is treated. The water comes by gravity in stone-laid drainage pipes and is then taken care of by oxidation ponds. SIPCOT Perundurai industrial plan is an area designed for 54 different units within textile processing. The processes run at the textile industries are dying, bleaching and yarning. The industries in SIPCOT are mainly working with cotton. The cotton contributes with much organic matter in the water effluent. Each of the industries has two different pipe systems for wastewater. One system is taking care of the water from the first washing after dying, called the dye bath effluent. This water has always very high TDS, over 2100 mg/l and is therefore not measured. The other system is far the remaining effluents from acid wash, water washing, soap washing and softening water are called wash water. The industries have a sensor that measures the TDS value from the wash water, ensuring that it does not exceed 2100 mg/l. If the value is higher a valve will close and direct the water back to the receiving tank to dilute with the other wash water. The textile has two different effluent wastewater streams. The dye bath has a high TDS, above 2100 mg/l, and the wash water has a lower TDS, below 2100 mg/l. Each industry will also measure the flow in both effluent pipes. All effluent from the industries is sent to Perundurai Common Effluent Treatment Plant, PCETP.

V. PERUNDHURAI COMMON EFFLUENT TREATMENT PLANT

Each industry bears the responsibility for dealing with the effluent water from their processing. Therefore the 14 textile units together formed PCETP. Each of the units has different shares in the treatment plant and consequently they are allowed different maximum flows that they can discharge to the treatment plant. The treatment plant only handles industrial effluent from those 14 textile industries. PCETP can operate 3600 m³/d wash water and 450 m³/d dye bath.

VI. DYEBATH TREATMENT PLANT

The dye bath treatment uses an evaporator for cleaning the water. Before the evaporator the water is pre-treated in the form of sedimentation and fine screening. The evaporation unit is a high technology system that vaporizes the water in five different evaporation tanks, three falling and two forced circulation (vacuum) tanks. They reduce the power input by using two heat exchangers and by doing so recover heat from the outgoing water to the incoming water. The outcomes from the evaporation tanks are two different waters, distilled water that goes back to the industries and the second water that goes to solar dryer ponds. The water in the solar dryer ponds evaporates to the atmosphere in 10 days. The rest consists to 95% of sodium chloride (Na Cl). The salt is collected from the bottom of the ponds and stored in sacks under roof. They produce 3.6 tons of salt every day and the space for storage is limited so this soon becomes a big and critical issue. Purify the salt where it can be reused in the textile industries.

VII. WASHWATER TREATMENT PLANT

The wash water treatment plant was opened in July 2002 which reduces COD and BOD by 40-60%. They regularly measure pH, TSS, BOD, COD and TDS. The plant has no seasonal variation as the textile industry produces the same 148 quantity the throughout the year. However, the hourly inflow varies widely in both quality and quantity. The receiving tank and the bar screens are designed for the peak flow, but the units downstream. If the equalization tank are designed for an average flow and an average quality. The energy consumption is approximately 0.9 kWh/m³ water treated and the cost is Rs.12-20 m³ treated water.

VIII. REVERSE OSMOSIS

The process of Reverse Osmosis is based on the ability of certain specific polymeric membranes. Usually cellulose acetate or nylon to pass pure water at fairly high pressure through the membranes. Since water is a necessity of life, it is important to drink water free from contaminants. To treat water and make it worth drinking, different processes are used and one of best treatment methods is Reverse Osmosis.

Figure 2. Osmosis plant

IX. IMPORTANCE OF REVERSE OSMOSIS

Reverse osmosis is comparatively newer method of treating water and purifying it but has emerged to be one of the best. You can contact a professional company to fix an RO system in your home so that you have access to clean and fresh water. You and your family can thus be safe and free of diseases related to water contamination.

X. CONCLUSION

RO was successfully used for the treatment of woven fabric dyeing effluent. The textile plant effluent was treated by biological treatment process. The recycling treated waste water and zero waste water discharge concept were found technically flexible and economically visible in the textile dyeing industries.
The average percent removals of BOD, COD, TDS and chlorines in the advance treatment technology are in the range of 88-98%, 91-97% and 75-97% respectively. Wastewater can be treated new techniques to produce fresh water quality for non-portable uses at reasonable cost. Reverse osmosis permeate gives better results of TDS-96% Chlorine-95% and Total hardness-99% reduced. These industries have a telling need for technologically feasible and economically justifiable.

XI. REFERENCE

