Treatment of Secondary Effluent of Textile Industry Using RO and Single Stage Evaporation- Approach to ZLD

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Abstract: **Textile industry is the major source of water consumption and wastewater pollution. Textile printing and dyeing processes include pretreatment, printing/dyeing, finishing and other technologies. Pretreatment includes desizing, scouring, washing, and other processes. Major pollution problems in textile industry are colour, COD, dissolved solids, toxic metals, residual chlorine, which are such properties that directly affect the human health and aquatic life. Treatment systems are consisting of physico-chemical treatment and biological treatment. [8]Wastewater generated from dyeing process may contain residuals of dyes, leveling agents, salts, caustic soda and heavy colour load, which makes biological degradation, becomes difficult and treatment is not feasible. It is necessary to find the most suitable treatment method for textile wastewater that will minimize the production and investment costs of wastewater treatment plants. So the advance treatment RO and evaporation technique is to be used. For reusing and recycling purpose of water, this two techniques is best, which produce high quality water, reduce volume of waste and achieves zero liquid discharge. Permeate from RO is reused for processes. Reject from RO is sent for evaporation.[3]**

Keywords: **Reverse osmosis, textile effluent, evaporation, recycling of wastewater.**

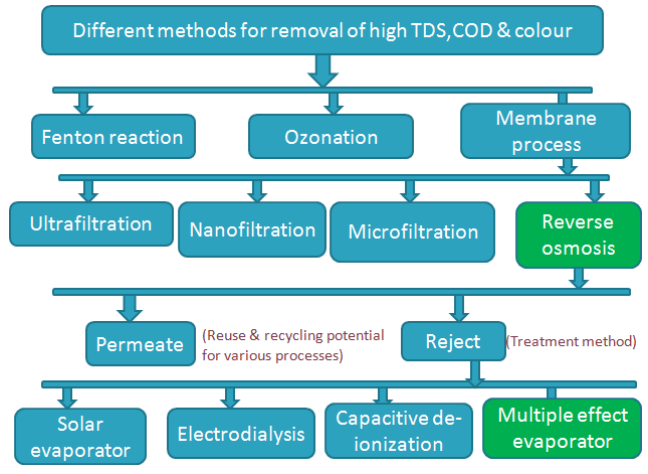
I. INTRODUCTION

India is the one of the world's largest producers of textiles and garments. 'cloth' which are supplied by processing of natural and man-made fibers in the textile industries is the basic need of human. Textiles account for 14% of India's industrial production and around 27% of its export earnings. Textile processing comprises pretreatment, dyeing, printing and finishing operations. Dyeing is a combined process of bleaching and coloring, which generates voluminous quantities of wastewaters and in turn causes environmental degradation .These production processes produce substantial wastewater. The textile dyeing industry demands large quantities of water and produces wastewater having high load of contaminants.[4] Textile processing employs a variety of chemicals depending on the nature of the raw material and product. Hosiery fabrics processes requires salt, salt used is either sodium chloride (NaCl) or sodium sulphate (Na_2SO_4). This generates large quantity of effluent is in the range of 5000-7000 mg/L with chloride in the range of 2000-3500 mg/L as compared to the tolerance limits of 2100 mg/L for TDS and 1000 mg/L for chlorides. More than 80% of the salt and 90% of the color is discharged. The salt is largely unaffected by biological treatment methods. Major pollutants in textile wastewaters are high suspended solids, chemical oxygen demand, heat, color, acidity, and other soluble substances. Wastewater discharged in to the main water decreases the light permeability in the water environment and affects the photosynthetic activities negatively. Accumulation of dyeing substance cause great damages to the human body, functions of kidneys, reproductive system, liver, brain and nervous system by making toxic and carcinogenic products. The wastewater of cotton based textile units is usually alkaline,

Whereas synthetic and woolen fabric processing generates acidic effluent.[1]

II. EFFLUENT TREATMENT

There are different methods for treatment of secondary treated textile effluent but some methods have disadvantage.



III. LIMITATIONS

Fenton reaction: It requires additional chemical cost, removing mud cost, the potential of polymerization reactions,

potential corrosion problem, continuing of normal chemical reactions.[7]

Electro dialysis: Problems associated with electro dialysis process is chemical precipitation of salts with low solubility on the membrane surface, clogging of the membrane by the residual organic matter.[2]

Ozone process: There are organic materials that it gives very slow reactions or do not enter in reaction.[7]

Ultrafiltration: It enables elimination of macromolecules and particles but the elimination of polluting substances, such as dyes, is never complete.[2]

Nanofiltration: Treatment of dyeing wastewater by nanofiltration give dissolved solids which makes discharging the treated effluent into the water streams impossible.[2]

Solar evaporator: Solar evaporator has disadvantage like it uses lot of space, solar energy storage is expensive and weather dependent.[2]

Textile wastewaters include various combination of biological, physical and chemical methods, but these methods require high capital and operating costs. Technologies based on membrane systems are among the best alternative methods that are adopted for large-scale ecologically friendly treatment processes.[4]

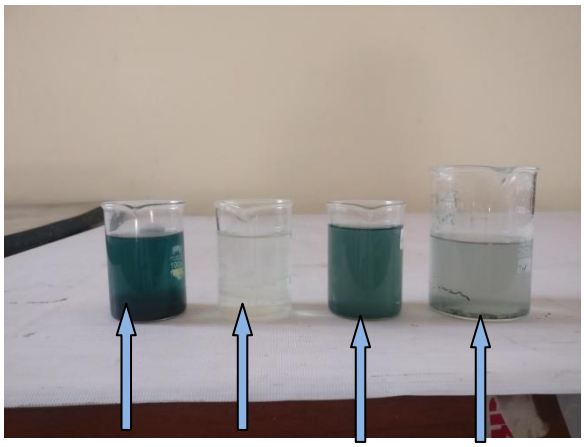
IV. PRINCIPLE OF REVERSE OSMOSIS

It is a pressure driven membrane desalination process. The process is also known as hyper filtration. It is heartening to note that this process has undergone the most rapid development of any desalination technique. The fluids of different concentrations in a tank are separated by a membrane; the dilute solution will flow through the membrane into the concentrated solution. It is called osmosis.[6]

V. LAB SCALE SETUP OF RO

I had taken the different results at different dates from the two membranes. Permeate from the RO is use for another process.

Image of Lab scale set up of RO



INLET PERMEATE REJECT CONDENSATE

Membrane used for treatment of secondary treated effluent is given below:

1-Dow

2-CSM

Volume of effluent: 2 L,

Temperature: ambient,

Flow: 1.6 LPM.

VI. RESULTS

(1) Result of Dow membrane,

[1]Results of TDS in (mg/L)

Sr. No.	Date	Permeate	Reject	Inlet
1	29-12-2017	142	3640	4270
2	1-1-2018	357	3190	4289
3	2-1-2018	305	2430	4260
4	4-1-2018	238	2460	3980

[2]Results of COD in (mg/L)

Sr. No.	Date	Permeate	Reject	Inlet
1	29-12-2017	120.3	640.2	589.06
2	1-1-2018	90.2	595	591
3	2-1-2018	75.2	610	580.3
4	4-1-2018	192	440	341

[3]Results of Colour in (cu)

Sr. No.	Date	Permeate	Reject	Inlet
1	29-12-2017	21.6	284	780
2	1-1-2018	14.6	189	760
3	2-1-2018	16.0	162	766
4	4-1-2018	20.8	170	1231

[4]Results of Turbidity (NTU)

Sr. No.	Date	Permeate	Reject	Inlet
1	29-12-2017	2.89	4.48	27.1
2	1-1-2018	5.14	8.19	26.9
3	2-1-2018	5.98	9.21	25.4
4	4-1-2018	2.86	6.72	10.9

(2)Results of CSM membrane:

[1]Results of TDS in (mg/L)

Sr. No.	Date	Permeate	Reject	Inlet
1	10-1-2018	87.3	2440	3980
2	17-1-2018	468	3998	3987
3	19-1-2018	504	4310	3889
4	22-1-2018	0.0	4768	1080
5	24-1-2018	0.0	2364	868

[2] Results of COD in (mg/L)

Sr. No.	Date	Permeate	Reject	Inlet
1	10-1-2018	11.73	422.4	341
2	17-1-2018	14.4	631.38	320
3	19-1-2018	28.8	890.3	355
4	22-1-2018	70	938.46	342
5	24-1-2018	41.6	850.6	496

[3]Results of Colour in (cu)

Sr. No.	Date	Permeate	Reject	Inlet
1	10-1-2018	0.0	178	1260
2	17-1-2018	19.3	558	1226
3	19-1-2018	14.9	1221	1150
4	22-1-2018	25.7	2111	1230
5	24-1-2018	14.8	883	1290

[4]Results of Turbidity (NTU)

Sr. No.	Date	Permeate	Reject	Inlet
1	10-1-2018	0.24	3.93	12.9
2	17-1-2018	0.52	28.6	16.9
3	19-1-2018	1.92	132	12.6
4	22-1-2018	0.09	147	11.0
5	24-1-2018	0.0	90.9	813

VII. DISTILLATION UNIT

Before starting of simple distillation pH was maintain below 6.

Image of Distillation unit

Heat -48-60 °C,

Volume of reject taken for distillation is 100 ml, volume of condensate is 100 ml. Time taken for distillation is 28:26 (28 minute and 26 second).

VIII. CONCLUSION

The Chemical Oxygen Demand test is widely used as a means of measuring the organic strength of domestic and industrial wastes. This test allows measurement of a waste in terms of the total quantity of oxygen required for oxidation to carbon dioxide and water. It is based on the fact that all organic compounds, with a few exceptions, can be oxidized by the action of strong oxidizing agents under acidic conditions. The COD of the reject increase significantly, while the COD of the permeate is considerably low. COD of condensate is below 70 mg/L, TDS is below 500 mg/L.

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