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Recent Development in the field of Environmental Engineering with Special relation to Waste Water Treatment Plant

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ABSTRACT: For sustainable development of India it is important to safeguard environment. Polluted and toxic water coming out of various manufacturing industries viz. chemical and textile is the biggest challenge for the ecology and its protection. Concern with environmental crisis is the most recent manifestation of ancient issues. Scientific knowledge and technological development provide us with new tools that lead to environment management and protection. Effluent Treatment Plant is specially designed to purify industrial waste water for its reuse and to release safe water to environment. It works at various levels and involves physical, chemical, biological and membrane processes to clean waste water from industries. Primary treatment involves flocculation, coagulation, neutralization, primary clarifiers, secondary treatment or biological treatment include activated sludge process, aerated lagoons, trickling filters, rotating biological contractor and finally tertiary treatment involve chemical coagulation and sedimentation, reverse osmosis, UV disinfection and nano-filtration system. In the present study incorporated innovative and recent developments viz. nano-filtration system in the field of ETP.

KEY WORDS: Environment, waste water, rotating biological contractor, reverse osmosis, Nano filtration.

I. INTRODUCTION

The UN Sustainable development goals (SDGs) adopted by international community in 2015 mainly covers social, economic and environmental dimensions. Sustainable development is that development which meets the need of the present without compromising the ability of future generations to meet their own needs. [1], [2] Water is relatively more prone to pollution than air because it is more viscous and possessing closer molecular distance than air. The unequal distribution of water on the surface of earth and the fast declining availability of fresh usable water per capita per year due to increasing population, are the major causes for concern in terms of quantity and quality of water.[4] [5], [6]

Biological Oxygen Demand, Chemical Oxygen Demand, Dissolved oxygen, heavy metal, pH, temperature, presence of heavy metal, AOX value salts, inorganic non-biodegradable substances are the main parameters for estimating quality of water. [7] Nano technology is building machines on the scale of molecules, a few nanometers (one thousand millionth of meter) with atomic precision. Usually it is concern with dimensions of less than 100 Nano meters.[8], [9]

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Environmental pollution due to dyeing is mainly related to water pollution. Water-polluting substances may originate from:

- The dyes themselves.
- Auxiliaries contained in the dye formulation.
- Basic chemicals (e.g. alkalies, salts, reducing and oxidising agents such as sodium chloride, sodium carbonate, sodium sulphide, sodium hydrosulphite) etc.
- Contaminates present in the fibre (e.g. residue of pesticides on wool, cotton and spin finishes on synthetic fibres).

Dye classes, their characteristics and pollutants with the dyeing process:

S. No	Dye class	Characteristics	Fiber	
			suitable	Pollutants
1	Acid	water-soluble, anionic	wool, silk, nylon	color, organic acid.
2	Basic	water-soluble, very bright shades	acrylic, mod-acrylic, PET	color, dyeing auxiliaries
3	Direct	water-soluble, anionic	wool, silk, cotton	color, salts
4	Reactive	water-soluble, covalent bond, popular	cotton and other cellulosics, wool, silk, nylon	color, salts, alkali, soaping agent
5	Sulphur	insoluble solubilised on alkaline reduction	cotton and other cellulosics	color, sodium sulphide, alkali, oxidising agent.
6	Vat	water-insoluble, chemically complex solubilised on strong alkaline reduction.	cotton and other cellulosics	color, sodium hydrosulphide, alkali
7	Disperse	water-insoluble, low molecular weight	Polyester/ Cellulose acetate	color dispersing agents organic acid, carrier

II. RELATED WORK

In this study, the nano filtration pilot plant is shown Fig 1 and Fig 2. This is especially effective dyes to achieve 100% decolouration efficiency, 72% salt reduction in waste water and excellent COD reduction.

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Typical salt application for direct and reactive dyes on cotton:

shade	Dye owf (%)	amount of salt Direct dyes (g/l)	amount of salt Reactive dyes (g/l)
Light yellow	< 1.6	3-8	30-50
Medium Red	1.0-3.0	8-12	60-70
Dark Blue	> 3,0	12-20	70-100

Bio elimination capabilities of different important dyes:

1. Adsorption of hydrolysed reactive dye on biomass is not as efficient as of other water-soluble dye classes. Bio-elimination of disperse is medium and acid dye is low while direct and basic dyes have good bio elimination.
2. High salt concentration in effluent lead to toxic effects and the land infertility. Countries have set emission limits at 2000 ppm or below.
3. Residual sodium sulphide acts as contaminant in the effluent. Sulphides are toxic to aquatic organisms and contribute to increasing Chemical Oxygen Demand (COD) load and corrosively.
4. The limits of discharge for heavy metals are stringent as they can be toxic to animals and aquatic life e.g. Reactive-arsenic, vat-copper.

Nano filtration (NF) is a cross flow filtration technology which ranges somewhere between ultrafiltration (UF) and reverse osmosis (RO). The nominal pore size of the membrane is typically about 1 nanometre..

Nanofilter membranes are typically rated by molecular weight cut-off (MWCO) rather than nominal pore size. The MWCO is typically less than 1000 atomic mass units (Daltons). The transmembrane pressure (pressure drop across the membrane is lower up to (3 MPa) than the one used for RO, reducing the operating cost significantly.

$R = \frac{Q_p \times 100}{Q_f}$ Where as Q_p = Permeate flow rate Q_f = Feed flow rate & R= Recovery of membrane.

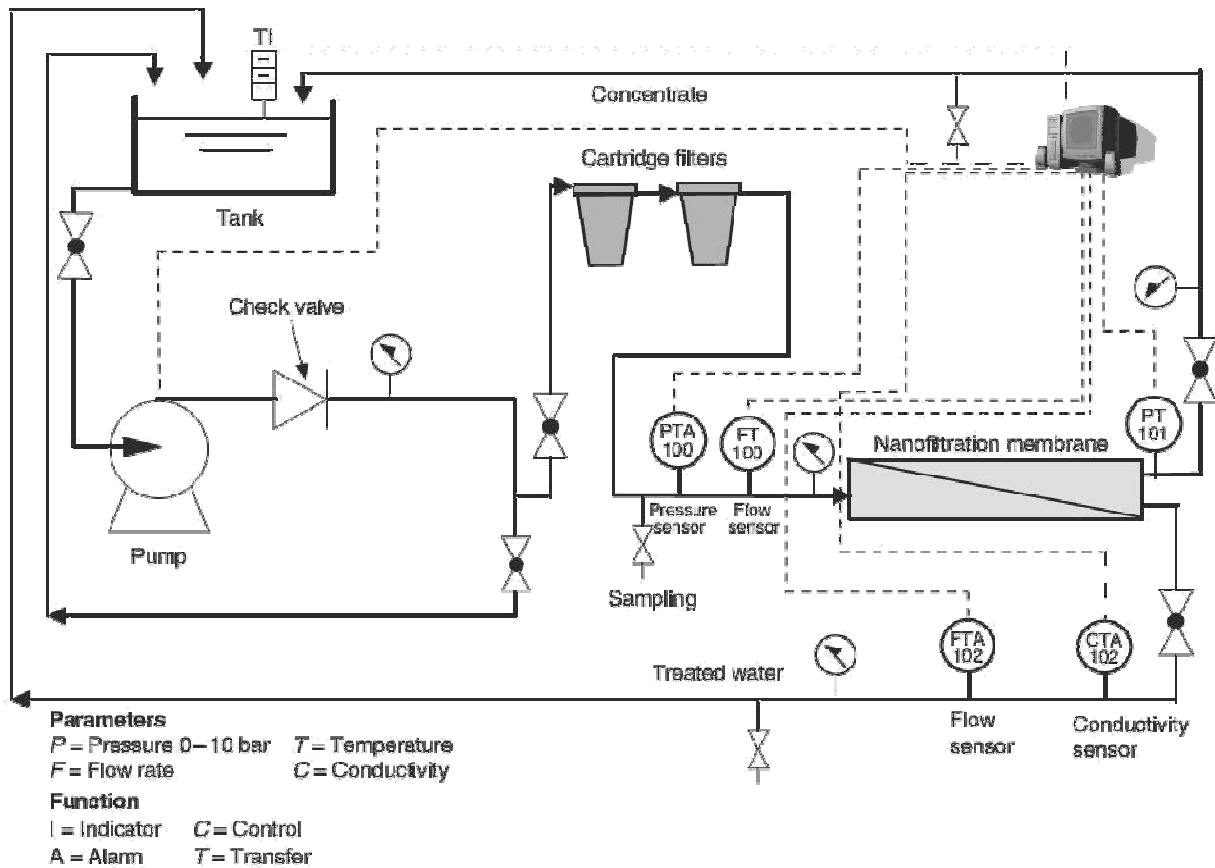


Fig. 1. Nano filtration pilot plant [4]

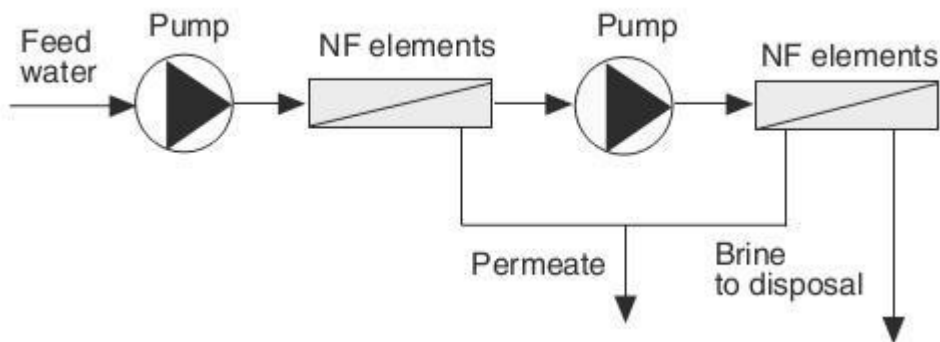


Fig. 2 Two passes configuration of nanofiltration system [4]

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III. RESULTS

The membrane efficiency and performance was tested at different operating conditions. The applied pressure was varied from 4 to 8 bar and the recovery from 4.6 to 54%. In all the experiments, even at extremely high recoveries, the decolorization efficiency was 100%, proving an excellent performance of this type of nanofiltration membranes for the treatment of dye effluents.

IV. CONCLUSION

Nano-filtration is found to be an efficient process for the treatment of waste water. It has capacity of achieving cent percent decolouration of effluents. Salt as well as reduction in chemical oxygen demand is excellent at lesser cost.

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