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Recycle Of High Quality Water From Sewage

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ABSTRACT

Water is a valuable resource for all living beings. Availability of water without chemical and microbiological contaminants is getting fewer these days. To overcome this challenge, we have made an attempt to convert sewage water to reusable water. The sewage from our college consists of effluents from hostel, canteen, laboratories and other environmental pollutants. The experimental setup consists of Stainless steel Backwashable Microfilter, Ultrafilter membrane and Reverse Osmosis membrane. Raw sewage water is pumped through this setup and the samples are collected at appropriate positions. The sample containing chemical parameters like Total Suspended Solids (TSS), pH, Conductivity, Bio-chemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Chlorides and Sulphates were analyzed and reported. The samples are also tested for the presence of bacterial colonies and the results are reported. All these results provided supporting evidence that the RO permeate water can be reused. Our future work aims to utilize the sewage sludge for the production of Bio-gas using Anaerobic Membrane Bio-reactor.

Keywords: Microfilter, Membrane Assembly, RO Membrane, Chemical Analysis

I. INTRODUCTION

Water is an essential resource. Increase of chemical and microbial contaminants make it unfit for reuse. In the current scenario water pollution is one of the greatest problems that could be resolved in order to bring out ecological balance. One of the finest methods for reducing water pollution is the sewage water treatment. Comprehensive sewage water treatment is an eco-friendly activity. It consists of several physical, chemical and biological treatment steps [1]. Physical treatment step involves filtration, clarification and reverse osmosis. Chemical treatment involves the addition of chemicals like urea, Diammonium phosphate and sodium hypochlorite. Biological treatment involves the growth of microbes in the aeration tank where Aerobic Biological Oxidation process takes place in which organic matter is converted into carbon dioxide, water, ammonia and new cells [2]. In this research work, a series of membranes are assembled for treatment of sewage and we have analyzed some of the important chemical and microbiological parameters at various sampling points. Based on the results of the analysis, the quality of the RO permeate water is compared with the Tap water and reported.

- Stainless steel Backwashable Microfilter.
- Ultrafilter membrane.
- Reverse Osmosis membrane.
- Booster Pump and pipes and fittings.

Block diagram

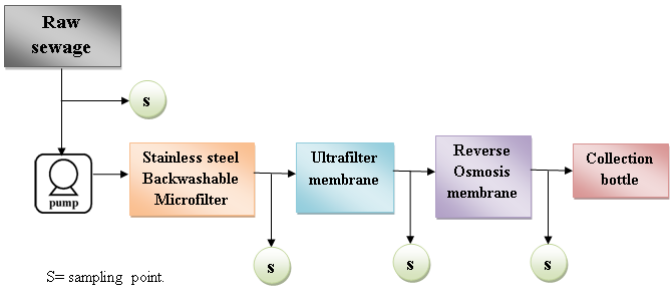


Figure 1: Experimental Setup

II. METHODS AND MATERIAL

The sewage water is first sent to the Stainless steel Backwashable Microfilter in which, solids are separated while the water enters into the Ultrafilter membrane. Samples are collected at the sampling points for analysis. The Total Suspended Solids (TSS) and the microbial content present in the water are greatly reduced in Ultrafilter [3]. Permeate from Ultrafilter is sent to Reverse Osmosis (RO) membrane for further processing whereas the reject from Ultrafilter is utilized for backwashing the Microfilter. The RO membrane still reduces the color, turbidity and conductance. The RO membrane outlet is collected in sample bottles. The experimental setup is shown in Fig.1. Chemical and microbiological analyses of the samples are carried out based on the procedures given by Indian Standards [4].

III. RESULTS AND DISCUSSION

Table 1: Chemical Analysis of influent sewage and effluents after different treatments

Chemical parameters	Sewage Sample (1)	Microfilter Sample (2)	Ultrafilter Sample (3)	Reverse Osmosis (4)	Tap water sample (5)
pH	6.65	6.78	6.74	6.8	6.75
TSS (mg/l)	2966.5	0	0	0	0
Conductivity (mS)	4.29	4.21	1.25	0.751	3.49
BOD (mg/l)	11.5	0	0	0	0
COD (mg/l)	24	56	40	0	8
Chlorides (mg/l)	425.4	212.7	141.8	10	212.7
Sulphates (mg/l)	965.6	504.21	121.41	76.1	730.17

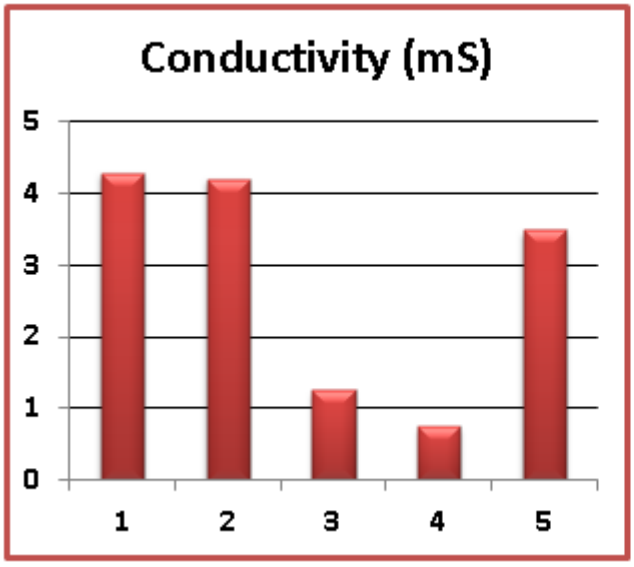
The chemical and microbial analysis of the samples at various sampling points is given in Table 1, 2 and 3. Results indicate that raw sewage is slightly acidic and having high TSS (Total Suspended Solids), Conductance, BOD (Biochemical Oxygen Demand) and COD (chemical Oxygen Demand). After passing through the series of membranes, chemical parameters like conductance, sulphates and chlorides, BOD and COD have reduced. The reverse osmosis sample gives better results than tap water and it is of high quality. On the other hand, microbial analysis shows the absence of colony forming units in the Ultrafilter and RO samples.

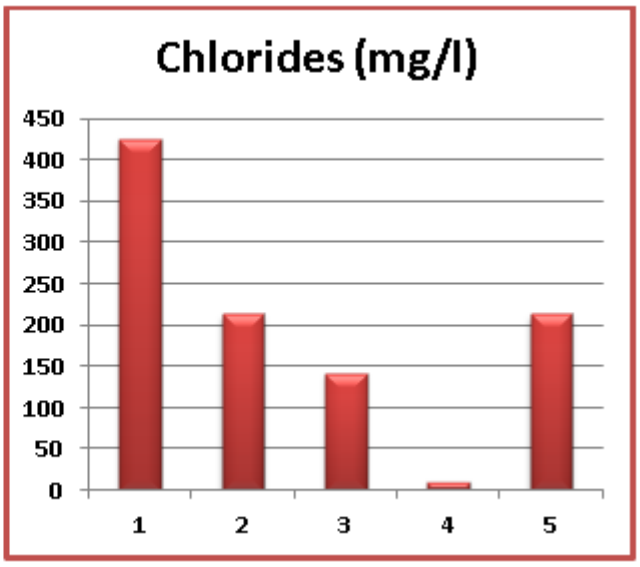
Table 2: Chemical Analysis of Influent sewage and effluents after different treatments

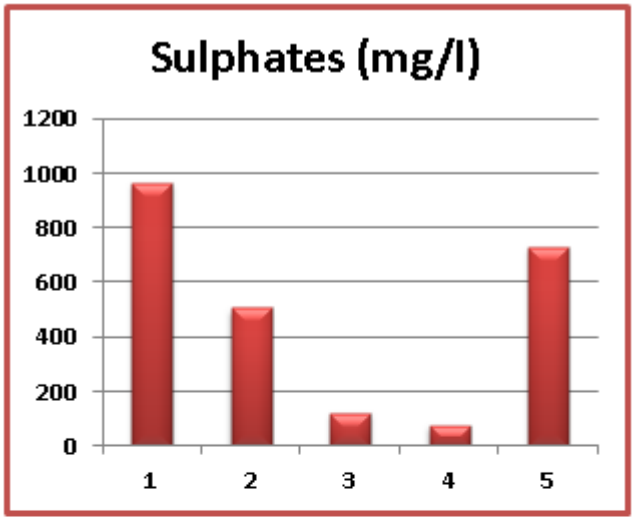
Chemical parameters	Sewage Sample (1)	Microfilter Sample (2)	Ultrafilter Sample (3)	Reverse Osmosis (4)	Tap water sample (5)
pH	7.42	7.36	7.14	6.68	6.75
TSS (mg/l)	1400	0	0	0	0
Conductivity (mS)	3.25	3.19	3.18	0.65	3.49
BOD (mg/l)	17.8	0	0	0	0
COD (mg/l)	20.0	32.0	28.3	0	10
Chlorides (mg/l)	205.6	134.8	63.8	10.6	212.7
Sulphates (mg/l)	288.1	288.1	123.48	82.32	535.08

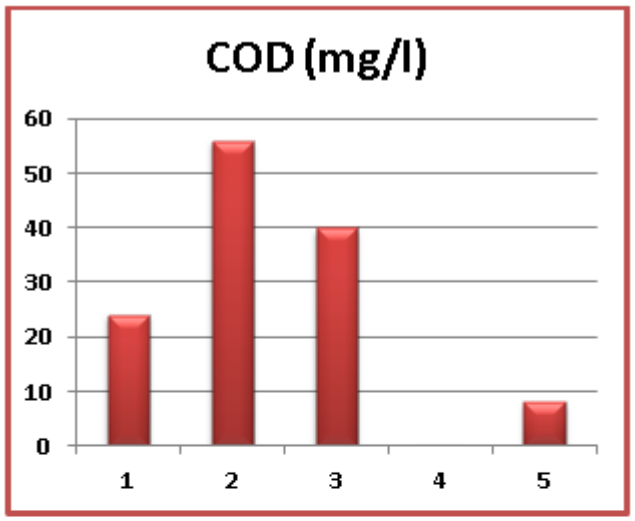
Comparison of chemical parameters

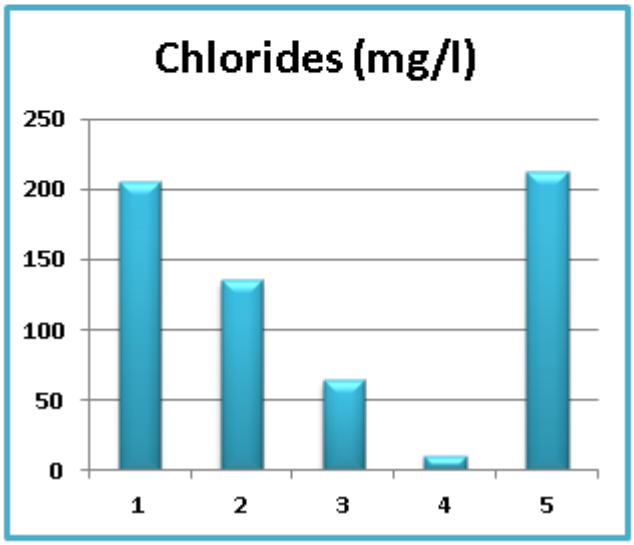
Iteration -1 parameters are shown in red colors and Iteration -2 parameters are shown in blue colors.

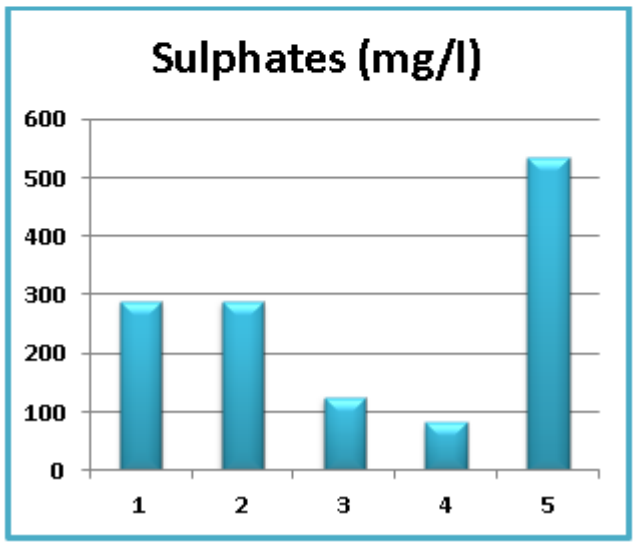


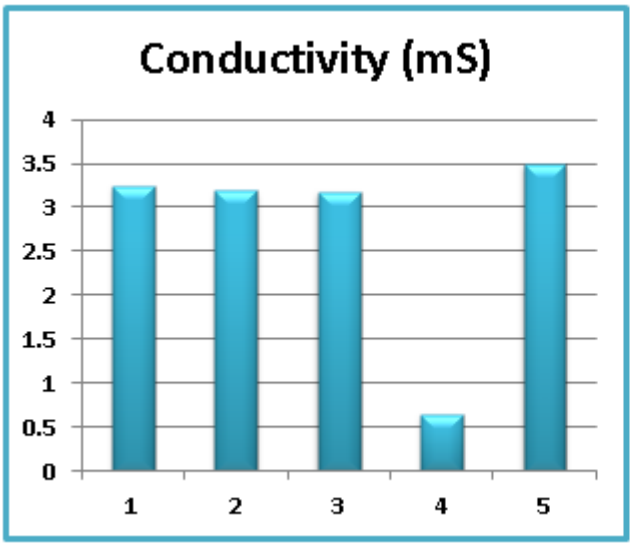












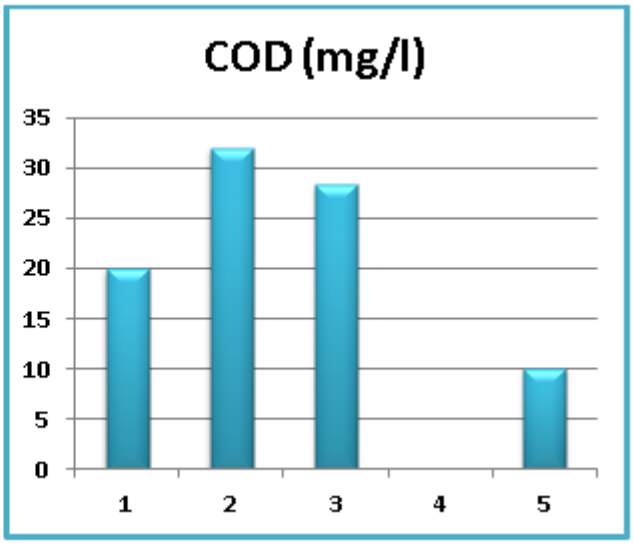


Table 3: Results of microbial analysis showing the reduction in count of bacterial colonies

Sewage sample (cfu/ml)	Microfilter sample (cfu/ml)	Ultrafilter sample (cfu/ml)	Reverse Osmosis sample (cfu/ml)	Tap water sample (cfu/ml)
2.67	1.32	0	0	0.55

IV. CONCLUSION

Results of chemical and microbial analyses of Reverse Osmosis outlet shows that the permeate water is purer than the tap water. Number of bacterial colonies in RO permeate is zero compared to that of tap water is 0.55 x 10^7 cfu/ml. Chemical analysis shows that Conductivity of RO permeate and Tap water are 0.751 mS and 3.49 mS, sulphates of RO permeate and Tap water are 76.1 ppm and 730.17 ppm and chlorides for RO permeate and Tap water are 10 ppm and 212.7 ppm respectively. BOD and COD are also lower for RO permeate than the Tap water. This clearly indicates that RO permeate water can be used for High-end applications like process water for Industries. This water can be used for Toilet flushing and other domestic applications other than drinking.

The Ultrafilter outlets which also do not have biological colonies can be utilized for gardening. Based on the requirement of recycle water for gardening and other applications, this process can be flexibly used to achieve better economy.

V. REFERENCES

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