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Nanofiltration a novel approach for waste water treatment

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ABSTRACT:

Nanofiltration (NF) is one of the widely used membrane processes for water and waste water treatment in addition to other applications such as desalination. NF separation incorporates a membrane with pore sizes and operating pressure, between the UF & RO membrane. NF membrane prevents the passage of only a portion of TDS & they remove the most dissolved organic matter occurring in natural water. NF when use actually improves the remove efficiency of color, COD, EC, alkalinity & TDS. NF is the pressure related process during which separation takes place during molecular size. NF used for potable water application typically molecular weight cut off of 200 to 400 Dalton. It also employs very high pressure and thin film membrane to filter particles of sizes on the order of 10nm.Nf membrane have up to 90% recovery rate. A TFC membrane have used in chemical application such as batteries and fuel cells.

Keywords: *Nanofiltration, Total dissolved solid, Electrical conductivity, Ultrafiltration, Reverse osmosis*

1. INTRODUCTION:

Nanofiltration (NF) is a relatively the membrane separation process known as nanofiltration is essentially a liquid phase one, because it separates a range of inorganic and organic substances from solution in a liquid – mainly, but by no means entirely, water. This is done by diffusion through a membrane, under pressure differentials that are considerable less than those for reverse osmosis, but still significantly greater than those for ultrafiltration. It was the development of a thin film composite membrane that gave the real impetus to nanofiltration as a recognized process, and its remarkable growth since then is largely because of its unique ability to separate and fractionate ionic and relatively low molecular weight organic species. The membranes are key to the performance of nanofiltration systems.. NF membranes tend to have a slightly charged surface, with a negative charge at neutral pH. This surface charge plays an important role in the transportation mechanism and separation properties of the membrane.

2. EXPERIMENTAL SETUP

Fig No.1:- Experimental Set-up

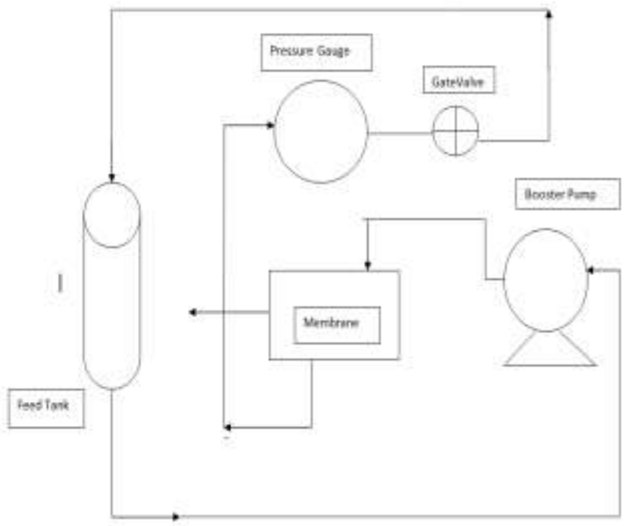

Fig No. 2:- Block Diagram of Nanofiltration

3. EXPERIMENTAL PROCEDURE:

Sampling:-

. Water sample are collected from three different corners of lake like Sample A, Sample B, Sample C.

NF Procedure:-

1. Conduct titration experiment to know total hardness of available water samples.
2. Clean the NF set up by distilled water properly.
3. Feed sample water to the feed tank.
4. Start the feed pump. Adjust the pressure by pressure regulator valve.
5. Collect samples and titrate it for the total hardness estimation.
6. Using constant burette reading, calculate the total hardness of the treated water.
7. Calculate percent reduction in the hardness of the water sample.
8. Repeat the procedure for different water samples.

Total Hardness:

Procedure:

Pipette out 10ml of the treated lake water sample into a 250 ml conical flask. Add 2 ml of the buffer solution and 3 drops of Eriochrome Black-T indicator. Titrate the solution with standard 0.1 M EDTA solution from the burette until the color changes from wine red to clear blue at the end-point. Note the titre value, which corresponds to total hardness.

4. OBSERVATIONS:

1. Membrane Used : Thin film composite polyamide NF membrane
2. Pressure : 40, 50,60,70 psig
3. Temperature : Ambient
4. Membrane are : 345.04 cm^2
5. Water sample taken for titration: 10 ml

5. OBSERVATION TABLE

Sample A

Table No.1 :- Permeate Flux Reading of sample

Sr. No	Water Sample Pressure (psig)	Constant Burette Reading(ml)	Permeate Flux (gm/cm^2sec)
1.	40	1.2	8.85×10^{-5}
2.	50	1	9.66×10^{-5}
3.	60	0.6	1.368×10^{-4}
4.	70	0.5	1.0465×10^{-4}

Sample B

Table No. 2.:- Permeate Flux Reading of sample B

Sr. No	Water Sample Pressure (psig)	Constant Burette Reading(ml)	Permeate Flux (gm/cm^2sec)
1.	40	3.4	6.037×10^{-5}
2.	50	3.3	5.635×10^{-5}
3.	60	3.0	6.198×10^{-5}
4.	70	2.8	6.440×10^{-5}

Sample C

Table No. 3:- Permeate Flux Reading of sample C

Sr. No	Water Sample Pressure (psig)	Constant Burette Reading(ml)	Permeate Flux (gm/cm^2sec)
1.	40	2.4	8.050×10^{-5}
2.	50	1.5	7.51×10^{-5}
3.	60	1.0	7.674×10^{-5}
4.	70	0.7	8.587×10^{-5}

6. CALCULATIONS

1. Permeate flux = Amount of permeate collected / (Area of membrane) x (time)

Sample A: At 40 psig

Volume = 5.5 ml= 5.5 gm

Permeate Flux = 5.5 / (345.04) x180 = $8.85X10^{-5}$ gm/cm^2sec

Sample B: At 40 psig

Volume = 7.5 ml= 7.5 gm

Permeate Flux = 7.5/ (345.04) x 360 = 6.037×10^{-5} gm/cm^2sec

Sample C: At 40 psig

Volume = 15 ml = 15 gm

Permeate Flux = 15/ (345.04) x 540 = $8.050X10^{-5}$ gm/cm^2s

7.RESULT & DISCUSSION

Table No.4.:- Vena Lake water Sample Results

Sr. No.	Characteristics (Parameter)	Unit	Analysis Result	DRINKING WATER-SPECIFICATION BIS 2012 IS 10500:2012	
				Requirement (acceptable limit)	Permissible limit in the absence of alternate source

1.	Color	Hazen unit	1	5 Max	15 Max
2.	Odour	--	Agreeable	Agreeable	Agreeable
3.	Temperature	ºC	20	--	--
4.	pH	--	8.34	6.5-8.5	No relaxation
5.	Electrical Conductivity	µmhos/cm	480	--	--
6.	Dissolved Oxygen	mg/lit	6.4	--	--
7.	Turbidity	NTU	7.6	1 Max	5 Max
8.	Total Solid	mg/lit	310	--	--
9.	Total Dissolved Solid	mg/lit	298	500 Max	2000 Max
10.	Suspended Solid	mg/lit	12	--	--
11.	Total Alkalinity (as $CaCO_3$)	mg/lit	132	200 Max	600 Max
12.	Total Hardness (as $CaCO_3$)	mg/lit	142	200 Max	600 Max
13.	Acidity	mg/lit	0	--	--
14.	BOD	mg/lit	3.4	--	--
15.	COD	mg/lit	14.0	--	--
16.	Total Colliforms	MPN/100 ml	34	Shall not be detectable in any 100 ml sample	
17.	Faecal Colliforms	MPN/100 ml	11	Shall not be detectable in any 100 ml sample	

↑ **Graph No. 1. Permeate Flux Vs. Pressure**

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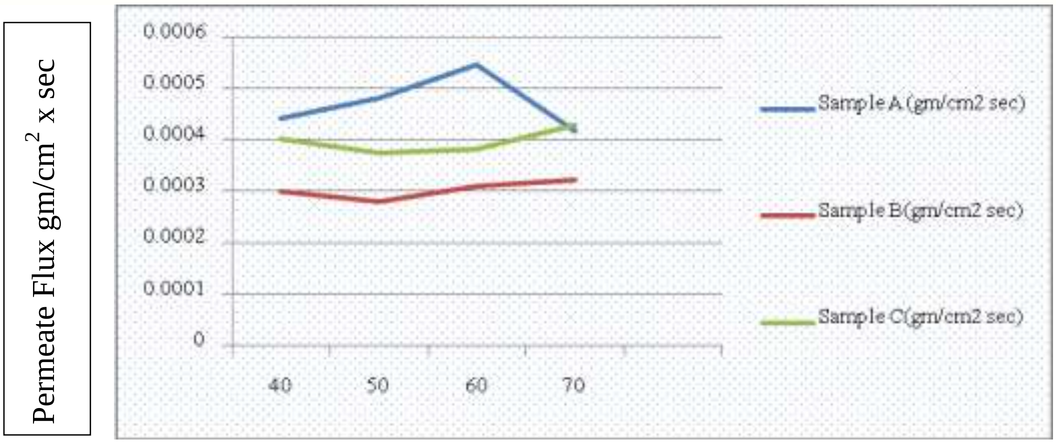

Pressure (psig) →

The permeate flux is one of the most important parameter in the evaluation of performance of filtration system. Higher the permeate flux the lower the filtration area necessary follow certain amount of solution to be proceed. From the graph It is observed that as TDS increase, hardness is also increases but turbidity decreases.

7. CONCLUSION

1. The result also shows that there is decrease in the value of TDS and conductivity when the waste water is finally treated with nanofiltration. This resulted value indicates that the treated water can safely be used for domestic purposes.

2. The performance of this commercial NF membranes has been extensively examined in terms of dye rejection, salt rejection permeate flux and COD rejection.

3. Nanofiltration when used actually improves the removal efficiency of the color, COD, Conductivity, alkalinity and Total Dissolve Solids (TDS).

REFERENCES:-

1. Chakra borty, S. S. De, J. K. Basu & S. Das Gupta, "Treatment of a Textile Effluent Application of Combination Method Involving Adsorption & Nanofiltration", Desalination, Vol 174, pp, 73-85 (2005).
2. Dhale, A.D & V. V. Mahajani, "Studies in Treatment of Dispersed Dye Waste; Membrane Wet Oxidation Process", Waste Manage, Vol 20, pp, 85-92 (2000).
3. Allegre, C. P. Moulin, M. Maisseu & F. Charbit, "Treatment & Reuse of Reactive Dying Effluent", J. Membrane Sci., pp, 1-26(2005).
4. A.I. Schafer, A. G. Fane, T. D. Waitie, "Nanofiltration-Principles & Application", Elsevier, Oxford, UK.,(2002).

5. B. Vander Bruggen, C. Vandecasteele, T.VanGestel, W. Doyen, R. Leysen, "A Review of Pressure Driven Processes in Waste Water Treatment & Drinking Water Production", Environment, Prog.,Vol 22, pp, 46-56 (2003).

6. K.Sutherland, "Developments in Filtration; What is Nanofiltration?", Filtration, Sep., pp, 32-35,45 (2008).

7. Zinck, J. Griffith, "Review of Mine Drainage Treatment & Sludge Management Operation", (2014).

8. D. Mourato, "MICROFILTARION & NANOFILTRATION", Ph. D. ZENON, Environmental Inc. Burlington, Ontario, Canada.

9. Xiaolei QuPedro, J.J. Alvarvz, QilinLi, "Application of Nanotechnology in Water & waste Water Treatment", Watres, (2012).