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SEPARATION APPLICATION OF TRACK-ETCH MEMBRANE

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Abstract: In this study, the application of track-etch membrane to separate impurities from different water samples has been observed. Polycarbonate membrane is used as a model Track-etch Membrane to remove impurities from different water samples and its comparison has been made with glass fiber based filter. Different parameters have been used to find out the separation efficiency of polycarbonate membrane like acidity, alkalinity, electrical conductivity, hardness, TDS, TSS and bacterial cell count. Different water samples like sewage water, blue bird lake water, industrial water and water from waste water treatment plant are used as model water samples for the experiments. All the experimental observations indicate that polycarbonate membrane based filter has efficiently reduced the impurities from different water samples. Glass fiber base filter also reduce the impurities from different water samples but polycarbonate membrane based filter was more proficient.

Keywords: Track-etch Membrane, Polycarbonate membrane (PCM), Glass fiber filter (GFF) etc.

I. INTRODUCTION

The process for fabrication of Track-etch Membrane was first of all patented by Price & Walker from general electric's [1]. The use of nuclear tracks for the production of porous membranes was proposed almost immediately after the discovery of particle track etching in thin sheets of materials [2]. This achievement became an industrial technology quite fast. Since the early 1970 the polycarbonate track-etch membranes were available on the market. Basic information on the properties and possible applications of track membranes was presented in a classical monograph [3]. Further progress in this field was associated with new particle sources (accelerators), studies of new polymeric materials, search for new applications and development of numerous methods of modification. There are two main approaches accomplished for the preparation of porous membranes these are irradiation and chemical etching [4]. Polyethylene terephthalate (PET), Polycarbonate (PC), Polypropylene (PP), Polyvinylidene fluoride (PVDF), and Polyimides (PI) are the material used for the preparation of track-etch membranes [5]. Compared to above all, the sensitivity of PC is higher, which makes it possible to produce membranes with a pore diameter as small as ~0.01 μm and omit the UV sensitization stage. Polycarbonate track-etch membranes differ from other membranes by a lower resistance to organic solvents and a lower wettability hence it is the most acceptable material for the preparation of track-etch membrane [3,4].

Purification of deionized water in microelectronics, filtration of beverages, separation and concentration of various suspensions are typical examples of track-etch membranes. Adapted over the years to a variety of cell types, porous membrane filters are now recognized as providing significant advantages for cultivating cells and studying the cellular activities such as transport, absorption and secretion [6,7]. Track-etch Membranes are also used for studying the transport of liquids, gases, particles, solutes, electrolytes [8-10] and electromagnetic waves through narrow channels [11]. To evaluate track-etch membrane as a separation of water owing to social issues and economic issues. Hence we are studying by experiments to improve the efficiency of track-etch membrane for the separation application. In the present study, the efficiency of track-etch membrane over separation of water permeation of chemicals have been investigated with the objective.

II. MATERIALS AND METHOD

Water samples from different sources like Sewage water, water from Blue bird lake, Industries and

III. RESULT AND DISCUSSION

Acidity

It is found from the following observations acidity of different water samples has decreases while using polycarbonate membrane as compared with glass fiber membrane. The large difference in percentage Water treatment plant has been collected for the experiments. The separation efficiency of polycarbonate membrane with compare to Glass Fiber filter (GFF) made by Axiva Sichem Private Limited Delhi (India) has been practised. Acidity, alkalinity, pH, electrical conductivity, hardness, TDS, TSS, and bacterial count are some parameters used to study the separation efficiency of polycarbonate membrane (PCM). All the process had done in four samples of water and eight chemical parameters testing process. acidity has been observed in industrial water and minimum percentage difference was in sewage water. Based on these findings it was observed that PC track-etch membrane is better than GFF to remove acidity [12].

Fig.1. Acidity filtration study between GFF and PCM

Alkalinity

Phenolphthalein and Methyl orange was the indication has been used for alkalinity titration. Polycarbonate membrane show slightly improved alkalinity filtration as compared with glass fiber filter. Figure 2 represents Polycarbonate membrane based filter which is better than glass fiber filter [13,14,21].

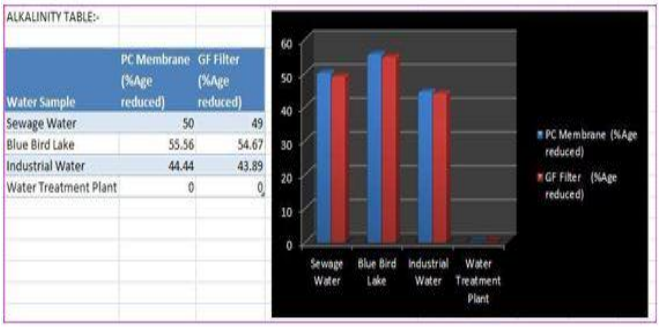

Fig.2. Alkalinity filtration study between GFF and PCM

Electrical Conductivity (EC)

Electrical conductivity of water is directly proportional to dissolved mineral matter content. We have compared electrical conductivity of polycarbonate membrane filtered water samples with glass fiber filtered water sample. The electrical conductivity in polycarbonate membrane filtered water sample was very low as compared to glass fiber filtered water. The electrical conductivity test results suggests that polycarbonate membrane based filter separate the mineral content efficiently from different water samples while glass fiber based filter was not so efficient [15,16,21].

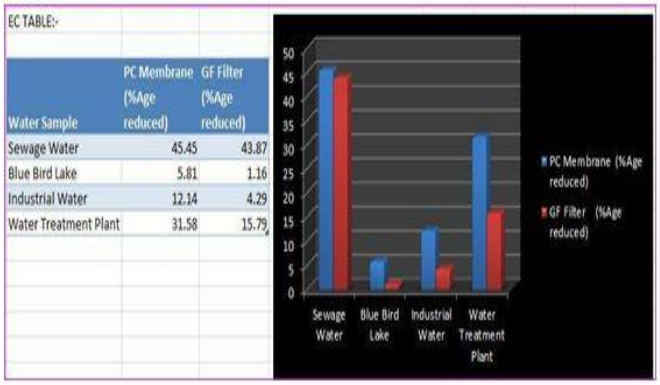

Fig.3. EC filtration study between GFF and PCM

Hardness

Calcium ion magnesium ion and its by-products are responsible for the hardness in water [17]. Therefore calcium ion and magnesium ion contents have been studied of different water samples after and before filtration by PCM and GFF. According to the results it is clearly visible that filter based on PCM effectively reduces the calcium ion as well as magnesium ion concentration from different water samples than GFF [18,21].

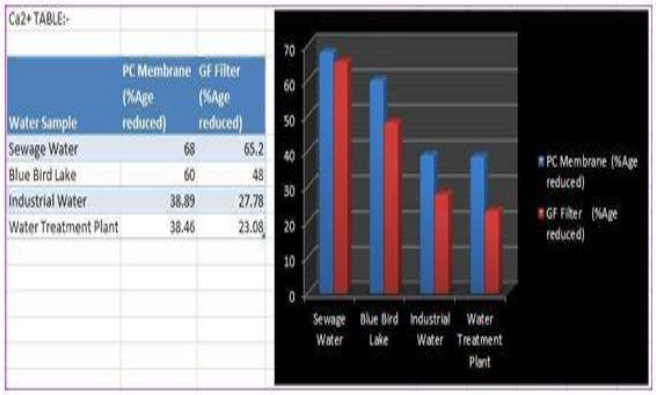

Fig.4. Ca^{2+} filtration between GFF and PCM

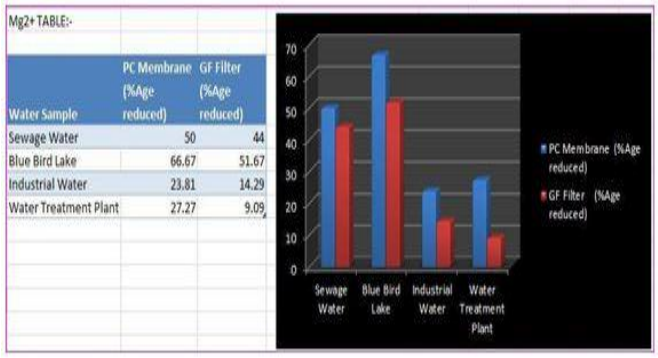

Fig.5. Mg^{2+} filtration between GFF and PCM

Total Dissolved Solids (TDS)

Total dissolved solids (TDS) in PCM filtered water samples were reduced slightly as compared with glass fiber filter. The results indicate that polycarbonate membrane based filter can replace glass fiber based filter in new generation of water filter [19,21].

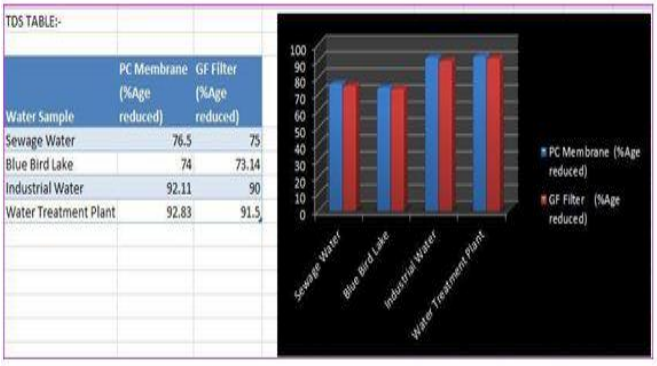

Fig.6. Total Dissolved Solids (TDS) filtration between GFF and PCM

Total Suspended Solids (TSS)

Total suspended solid (TSS) is used for water quality measurement. Total suspended solids (TSS) included all inorganic or organic particles which were filterable; these suspended solids present in water could be retained by the filter when passed through it. According to experimental observation suspended solids are effectively removed from the different water samples after filtration with PCM than GFF [20,21].

TSS TABLE:-

Water Sample	PC Membrane (%Age reduced)	GF Filter (%Age reduced)
Sewage Water	96.36	91.36
Blue Bird Lake	95.43	90.86
Industrial Water	98.5	93
Water Treatment Plant	95	92.5

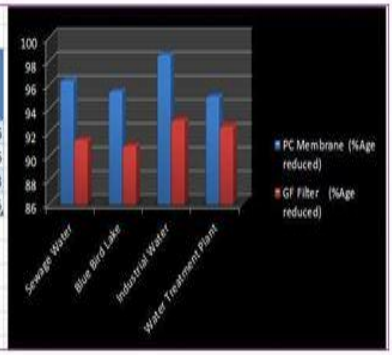

Fig.7. Total Suspended Solids (TSS) filtration between GFF and PCM

Bacterial cell Count

Polycarbonate membrane inhibits bacteria to pass through its channels because bacterial cell size is larger than the membrane's pore size. Due to this phenomenon polycarbonate membrane has reduced the bacterial cell count in polycarbonate filtered water samples. Glass fiber based filter also reduce the bacterial cell count in different water samples but it was not as efficient as polycarbonate based filter [20].

BACTERIAL COUNT TABLE:-

Water Sample	PC Membrane (%Age reduced)	GF Filter (%Age reduced)
Sewage Water	45	20
Blue Bird Lake	68.75	66.67
Industrial Water	42.22	33.33
Water Treatment Plant	62	58

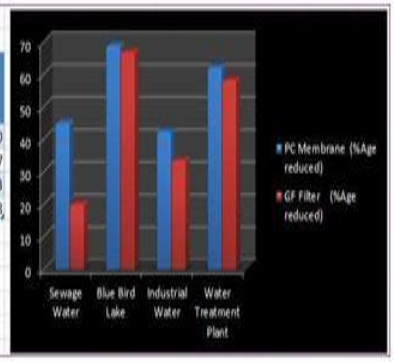

Fig.8. Bacterial Cell Filtration between GFF and PCM

IV. CONCLUSION

The result obtained by a variety of characterization of different chemicals parameters; reduction in bacterial count indicate that separation of water with the help of PC Track-Etch Membrane make water more potable. All the chemical testing parameters show that the impurity reduction from different water samples which is the need of present era to be free from disease and other ailments. Glass fiber filter also provide us a good result but as comparison to Track-Etch Polycarbonate Membrane it (GFF) is not much useful as polycarbonate membrane based filter. For the production of safe drinking water from low quality of water we need to remove natural organic matters and chemical substances carefully and selectively. Modern membrane filtration technology i.e. Track-Etch Membrane might be an attractive complete solution of these areas and could be used in preference to conventional separation method.\

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