INTRODUCTION:

During the past ten years significant advances have been made in reverse osmosis technology, including: 1) membrane casting methods, 2) chemical modifications of cellulose acetate polymers to obtain specific membrane properties, 3) module configurations, and more recently 4) non-polysaccharide membrane development. The non-polysaccharide membranes have exhibited significant advantages over polysaccharides in such areas of performance as flux, salt rejection, stability, and microbiological resistance.

Currently, several non-polysaccharide reverse osmosis membranes are commercially available. These include aromatic polyamides, aromatic polyhydrazides, polybenaimidazolone (PBSL),polyepiamine/amide, and polyepiaminefurea. Laboratory and pilot plant development is underway on other membranes including poly-ethyleneiminefurea (NS-lOO), sulfonated , polyfurane (NS-ZOO), polybenzimidazole (PBS), and polypiperazine isophthalamide[1]. In recent years there has been considerable growth in the utilization of reverse osmosis (RO) processes in major desalination plants. An RO purification system uses a semi-permeable membrane to remove ions, proteins, and organic chemicals which are generally not easily re-moved using other conventional treatments. Among the benefits of RO are its small footprint, a modular design and the possibility of automatic process control and relatively low-cost of water production.

RO has been used widely for various water and wastewater treatment processes in areas with scarce water supplies (as a means of sea-water desalination) and importantly for this study the treatment of brackish water. However RO desalination suffers from a high energy input demand, fouling of the membranes, and low-quality of the water compared to thermal technologies which produce very high quality. Nevertheless, the overall energy utilization remains considerable for RO desalination and as such the cost-effectiveness of production is highly sensitive to changes in energy prices and policy decisions related to greenhouse gas emissions. Typically, in an RO plant, the production of one cubic meter of fresh Much work has been carried out to reduce these limitations of RO desalination, including the development of novel membranes with high permeability to water but low permeability to saltwater from seawater uses 3–10 kWh of electricity, and between 0.5 and 2.5 kWh from brackish water[2].

ASSUMPTION OF RO MODELLING

- Solution-diffusion model is valid for the transport of water and solute through the RO membrane;
- The efficiency of the pump and turbine are fixed at 84% and 70% respectively.
- The pressure drop in feed stream is taken as the dead state 101.3 kPa.
- The salt feed water stream is considered to be a dilute solution and is treated as an ideal solution.
- The concentration polarization effect is negligible[3].

NEED OF REVERSE OSMOSIS ON GLOBAL LEVEL

It is evident that fluoride contamination is a worldwide issue. Global overview of ground waters with fluoride concentration exceeding the WHO guide line of 1.5 mg L1. The results show that areas most severely affected include East Africa, Middle East, Argentina, the United States, India and China. The occurrence of fluoride in natural waters is closely linked to the local geology. The chemical element fluorine is abundant in the Earth's crust (625 mg kg1) as a result of volcanic activity and fumarolic gases. Fluorides are naturally released into water by the dissolution of fluoride-containing rocks and soils. The dissolution process is affected by various factors including rock chemistry, groundwater age, residence time, well depth and conditions of the pathways .In addition to natural dissolution of minerals, industrial operations, such as metallurgical industries, fertilizer plants, and semi-conductor production, generate effluents with high fluoride contents. In the case of phosphate production, fluoride in the effluent can reach up to3000 mg l. Uranium, the other inorganic contaminant of interest, is a naturally occurring radioactive element. It has three main isotopes: 238U, 234U and235U, among 238U is the most prevalent form. The occurrence of uranium in European waters is in association with granite rocks and volcanic activities. High-uranium ground waters in Kazakhstan, Australia and Canada are often encountered in uranium mining areas since those three countries provide about 64% of the world's uranium production (World Nuclear Association, 2012). Leakage nuclear power plants and military use of depleted uranium also pose a high risk of uranium contamination into natural waters. Dental fluorosis and crippling skeletal fluorosis is are the first adverse effects that fluoride can have on the body, which are manifested by mottled teeth in mild and brittle bones and neurological complications in severe cases [4].

Ultrafiltration increases the content of protein in UF milk over that in unfiltered milk and hence its buffering capacity is increased. As a result, the amount of lactic acid that starter culture bacteria must produce to cause a unit change in pH is increased considerably over that needed when unfiltered milk is used. Thus, the ripening time of UF cheese milk is lengthened over that of unfiltered milk. The greater the degree of concentration, the more pronounced will be this increase in buffering capacity. Even though UF milk is a better growth medium for lactic acid bacteria than is unfiltered milk the high buffering capacity of UF milk requires production of larger amounts of lactic acid by starter bacteria than does unfiltered milk. Mistry et al. (53) indicated that addition of 0.5% yeast extract or a mixture of 22 amino acids, each at 0.04 mg/g, to retentive from milk concentrated 2:1 improved acid production as compared to the control [5].

EFFECT OF PRESSURE IN MEMBRANE FOULING IN FO AND RO

As demonstrated in our experiments, the fouling layers formed on the membranes in RO are irreversible and more compacted than those in FO under identical operational conditions (type of membrane, feed water composition, hydrodynamic conditions, and initial permeate water flux). We discuss two possible mechanisms for the compaction of the fouling layers in RO: (i) permeate drag force across the fouling layer and (ii) compression of foulants under hydraulic pressure[6].Fouling layers on membranes pose additional resistance to water transport by providing tortuous and porous structures. The porous structure of alginate gel with an effective pore size of 5–150 nm allows the water to transport via viscous flow , resulting in a pressure drop across the fouling layer. The corresponding drag force leads to a compressive force on the alginate egel structure in the flow direction [7].

COST APPROACH FOR RO MODEL

Because it is difficult to realize the big RO device in the laboratory we research small size RO unit cost instead. The results also provide certain theoretical basis for the large equipment. In a small device study some cost such as development fee, Labor, depreciation cost, engineering construction fee can be neglected [8].

FUTURE POTENTIAL OF RO MODEL

Today reverse osmosis (RO) is the most widely used desalination technology globally. Over the past few decades remarkable advances have been made in the preparation of RO membranes from different materials. RO membrane market is dominated by thin film composite (TFC) polyamide membranes consisting of three layers: A polyester web acting as structural support (120–150 m thick), a micro porous interlayer (about 40 m), and an ultra-thin barrier layer on the upper surface (0.2 m) . The polyester support web cannot provide direct support for the barrier layer because it is too irregular and porous. Therefore, between the barrier layer and the support layer, a micro-porous interlayer of polysulfonic polymer is added to enable the ultra-thin barrier layer to withstand high pressure compression. The thickness of the barrier layer is reduced to minimize resistance to the permeate transport. Membrane pore size is normally less than 0.6 nm to achieve salt rejection consistently higher than 99% [9].

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