Dead end and cross flow operation biology essay

Science, Biology

An other explanation of membrane is a layer of material that serves as a selective barrier between two phases and remains impermeable to specific particles, molecules, or substances when exposed to the action of a driving force. The membrane method is an important technology because of low energy of operation, spatial requirements, simplicity of operation using modern compact modules as well as recycling and reuse of chemicals and water promote membrane processes as a promising technique in separation procedure . Now a days we use membrane technology in this application for separation, concentration and purification in industrial unit operations due to its high efficiency of separation like these : Dialysis and other blood treatmentsmilk Concentration before cheese makingProcess of downstream (e. g., concentration) of biotechnology-derived proteins (e. g., therapeutic antibodies)Proteins Desalting and solvent-exchange (via diafiltration)proteins fractionationfruit juice clarificationvaccines recovery and antibiotics from fermentation brothLaboratory grade purification of waterIndustrial waste water treatmentDrinking water disinfection (including removal of viruses)endocrines removal and pesticides associated with Suspended Activated Carbon pretreatment (wiki)Rochem-FM modules with ultrafiltration membranes can be used especially for the bacteria separation, viruses and fine solids from water and wastewater with the high fouling potential. Ultrafilration is based on porous membranes. Particles bigger than the pore size of membranes are rejected. In practice even smaller particles are rejected since the selectivity of the filter cake (gel layer) on the membrane surface. Therefore ultrafiltration membranes form an absolute barrier for bacteria and viruses includung colloids and macromolecules. Rochem-FM

modules show very low specific energy consumption at high and steady state fluxes. Unique is the possibility of an optimal adaption of the feed path space (distance between membrane cushions) for the individual case. This feature can be used in a wide range of solid concentration

Dead-end and Cross-flow operation

Between the membrane separation processes, ultrafiltration (UF) has been widely used for product recovery and control of pollution in the chemical, coating of electrons, electronic, metal refining as well as in the food, pharmaceutical and biotechnological industries [11]. A cost effective advantage of ultrafiltration is the ability to perform two work in one-step such as concentration and separation. Molecules of the same size cannot be separated by UF but can separate molecules, which differ by at least an order of magnitude in size (5). The advantage of Uf method in compare with Other techniques, like ultracentrifugation and chromatography, are financially and time consuming. The sensitive nature of biological specimens to thermal and chemical environments limits the selection of the separation techniques employed. [8] the membrane ultrafiltration (UF), was also found more effective in the separation of soluble proteins from aqueous solutions . Proteins Separations by membranes was found to be advantageous, since it is non-destructive and the process limits proteins denaturation Heavy metals such as Cu2+, Ni2+, Zn2+ and Cd2+ could be separated and concentrated by binding target metal ions by a polyelectrolyte with water-soluble macromolecular compounds and subsequent membrane separation of the bound metals from unbound components[9].

Cellulose acetate:

Composition of celloluse/acetate blend , thisfiltrs show low static charge and high strengthlow aqueous extractable(0. 1 wt%) high resistance to heat and low molecular weight alcohol use for enzyme filteration solution, diagnostic cytology, or receptor binding studies and biological fluid filtration. Cellulose Acetate (CA) has been considered as the important membrane material due to its advantages such as gradually flux and high salt rejection properties. the removal of chromiumions from leather, electroplating, dye and textile industrial effluent is necessary from both environmental and economic point of view [4].

Modification of cellulose acetate

The first generation cellulose acetate (CA) membranes has negative points like yield low flux and are susceptible to chemical and bacteriological agents(12)., CA is not appropriate for more aggressive cleaning, has low oxidation, has poor resistance to chlorine, can be used only in the limited temperature range (maximum 30 ◦C) and has low mechanical strength,(10). narrow pH range (pH 2–8), low chlorine resistance, higher compaction phenomena which decreases membrane lifetime and high biodegradability, that reduced its usage(9). and we need the modification of CA obtain better charectristic [10] such as increase to aggressive cleaning and sanitizing agents and more chemical and mechanical resistant membranes. In modification of cellulose The hydrophilic/hydrophobic balance as well as the physico-chemical properties of a membrane can be changed if the membrane is well prepared from multicomponent polymer mixture/blends [14]. The performance of CA may be improved by mixing it with appropriate

additives to fulfill new requirements and related membrane properties. The separation of phase (inversion) method is one of the most common methods used to construct porous polymeric membranes [12]We want to explain the kind of synthesise of different modification and properties and important physical propertiesPreparation of membranesCA/SPEEKsulfonated poly(ether ether ketone) blend ultrafiltration membranes in various precentage composition percentage were provided and characterized. Membranes were prepared using standard method of phase inversion methods. The polymer solutionwas first cast on a smooth glass . Prior tocasting, a gelation bath consisting of DMF andSLS in distilled water (non-solvent) was prepared and the bath was ice-cooled. After solvent evaporation in the casting chamber, the glass plate along with the polymer film was intensed in the gelation bath. After gelation in an hour, the membrane was eliminated from the gelation bath and completely washed with distilled water to remove the remained solvent and surfactant from the membrane. Similar casting and gelation conditions were kept for all the membranes. Membranes were cut into circular forms . 1-The first derivatives definition and properties compared to pure CA is carboxymethyl cellulose acetate (CMCA)/cellulose acetate (CA) compared to the pure CA membrane, blending of CA with CMCA led to novel blend membranes with developed ultrafilteration membrane properties such as lower contact angle and higher PWF attached with higherwater contentBovineserumalbumin (BSA)was subjected to rejection by the blendmembranes [1]blend ultrafiltration (UF) membrane was prepared through phase inversion in the absence and presence of 2. 5 wt.% additive, called polyethylene glycol 600 (PEG 600). CMCAwas firstly synthesized

fromcarboxymethyl cellulose sodium (CMC-Na) by acidifying and esterifyingSynthesise of this membraneSajithet al. (2002). The dried udelpolysulfone (Mw = 35000 Da) was situated into a threeneckSchlenk facilitated with a dropping funnel, a thermometer, N2 inlet and a magnetic stirrer. polysulfone was dissolved in THF anhydrous and the solution temperaturewas decreased to 50ºC. n-Butyllithium (in hexane) diluted with THF was added dropwise over 12 minutes, during which time the mixture changed a red-brown color. The polymer was quenched after 30 minutes by the slow addition of CO2(S) during 30 min, and then warmed slowly to room temperature THF was evaporated on a Schlenk line to afford the white slurry. The polymer was precipitated into dilute aqueous HCl solution, washed with distilled water and ultimately dried at 50ºC in vacuum oven to gain a white solid .(15)2-The second derivatives of CAThe properties of New ultrafiltration membranes depends on chemically and thermally stable arylene main-chain polymers have been prepared by blending the sufonatedpoly(ether ether ketone) with cellulose acetate in various compositions in N, N0-dimethylformamide as solvent by phase inversion technique. The pore statistics and molecular weight cut-off (MWCO) of the membranes have been estimated using proteins such as trypsin, pepsin, egg albumin and bovine serum albumin. The pore size raised with increasing concentrations of sulfonatedpoly(ether ether ketone) in the casting solution. (14)3-poly (amide-imide) (PAI))/ cellulose acetate (CA) blend , cellulose acetate (CA) membranes with better properties were prepared by phase inversion technique using high performance thermoplastic poly (amide-imide) (PAI) as the modification agent. The modified membranes were used for the

separation of metal ions from aqueous solutions by polymer developed ultra filtration. Efforts have been made to correlate the changes in thermal, mechanical characteristics and membranes performance with morphology. It is worth mentioning that the prominent thermal stability and separation efficiency of these membranes caused by the fine dispersion of PAI in the CA matrix clearly offers immense potential in industrial separations (11)4-celluloseacetatelpolyurethane blend membranes , Cellulose acetate membranes were prepared by solution blending of cellulose acetate with polyurethane in polar solvent. The effect of different concentrations of additive, polyvinylpyrrolidone, on the performance of modifed cellulose acetate/ polyurethane blend membranes was investigated. The cellulose acetate/polyurethane membranes were characterized relied on pure water flux, compaction, water content, morphological studies and applied for proteins separations by ultrafiltration technique and are argued in detail(8)5-Epoxy functionalized poly(ether-sulfone) combined cellulose acetate ultrafiltration, Epoxy functionalized poly(ether-sulfone) (PES) was prepared and it was used as the hydrophilic modificationagent for the preparation of high implementation cellulose acetate (CA) membranes by phase inversion technique. The contact angle measurements showed that the hydrophilicity of the CA membranes developed in the addition of EPES. The performance of these membranes in the separation of chromium ions was discussed and found to be developed noticeably in CA/EPES blend membranes. Efforts have been made to relate the changes in membrane morphology with the compaction, pure water flux, water content and separation efficiency of the CA/EPES membranes. According to results, it was inferred that CA

ultrafiltration membrane prepared by the inset of EPES may be valuable in the removal of chromium ions fromaqueous streams(4)6-cellulose acetate/sulfonatedpolysulfone and cellulose acetate/epoxy resin blend CA and epoxy resin (diglycidyl ether of bisphenol-A) were blended in different compositions, in the presence and in the absence of polyethyleneglycol 600 as non-solvent additive, using N, N0-dimethylformamide as solvent, and used to make ultraflltration membranes by phase inversion methods(6)7-Cellulose acetate and polycarbonate blend were prepared by the inversion of phase technique in 100/0, 95/5, 85/15 and 75/25% polymer blend compositions in the absence and presence of a polymeric additive, poly(ethylene glycol) 600, at different additive concentration and were used for the proteins rejection trypsin, pepsin, egg albumin (EA) and bovine serum albumin (BSA). The toxic heavy metal ions copper, nickel, zinc and cadmium from dilute aqueous solutions were subjected to rejection by the blend membranes(9)

Effect of polymer blendcomposition on compaction of Membranes.

From the table it is observed that In blend membranes of cellulose acetate withunmodifiedpolysulfone, when the blend component (unmodified polysulfone) was risen , the steady state flux was observed to rise moderately. Similarly, in blend membranes of celluloseacetate with carboxylatedpolysulfone of 0. 14 degree of carboxylation, an increase in the blend component, CPSU, increases the steady state flux. Thus, an increase in the composition of carboxylatedpolysulfone in the blend increase the hydrophilicity of the membrane and hence a higher flux has been seen for

membranes with higher composition of carboxylatedpolysulfone. The comparatively higher flux in membranes with higher carboxylated polysulfone content may also be because of partial compatibility of the blends, which cause a larger polymer chain segmental gap between cellulose acetate and polysulfone.

Effect of polymer blendcomposition on PWF ofmembranes

The flux through the membrane is the density of how fast the membrane can process the water that is being passed through it. Flux is measured in volume of water per unit area per unit time. This is one of the most important feature of a membrane since in an industrial sized application a huge amount of fluids need to be processed so, the larger the flux of a membrane the more advantageous. The higher flux of the membranes are attribute able to differences in inter-chain displacement and flexibility, which in turn are casually related to polar and steric effects.

Effect of polymer blendcomposition on water contentof membrane

The pure water permeability of membranes is a water content function and is relevant to the void the membrane volume. The percentage of the membrane water contents samples were decreased from their wet and dry weights , As polysulfone concentration in theblend enhanced, the immiscible nature of the blend increases cause to poor adhesion characteristic between cellulose acetate and polysulfone chains . This conducts to increase in void membrane volume by increase in the size of molecular polymer congregate in thecasting solution resulting in the organization of bigger pores. This in turn enhanced the water uptake of pores reflected by the increased water

content at higher polysulfonecompositions in the blend . alikely, the water content of blend membranes was showed to increase gently, when carboxylated polysulfone of 0. 14degree of carboxylation, was increased in blend membranes of CA/CPSU.

Effect of polymer blendcomposition on hydraulicresistance of membranes

Membrane hydraulic resistance (Rm) is the intrinsic resistance of the membrane determined using pure water that plays the role of the feed It is an indication of the tolerance of the membrane towards hydraulic pressure and is determined by subjecting the membranes to different pressures. generally, the pure water flux is increasing with the growth intrans membrane pressure. This is because the increase in the operating pressure rises the driving force forpermeation of water.(12)Further more when the polysulfone content in the blend was replaced bycarboxylated polysulfone , the membrane resistance reduction. This may be explained by the fact that, an increase in the composition of polysulfone in theblend not only increases the amorphous nature of the membranes, but also increase the size of pores to agreater extent due to extended segmental gap betweenpolymer chains which leads to the decrease in themembrane hydraulic resistance

Membrane compaction

The compaction was aimed to constract membranes with rigid pore structure and size, which could extra yield reproducible outcome in proporties and performance evaluation(12)During compaction, primarily the pure water flux decrease gently and and attains a steady state. This may be owing to the fact which the membrane pores are compacted in priod of time by the

pressure application. The direct analysis technique using responses of flux and rejection can be apply to judge the membrane with the formost performance. The most ideal membrane could have a impartial balance between flux and rejection. A very high rejection means a fairly low flux until a fairly high flux means that not all particles are being properly separated. (16)

Pure water flux

PWF as a follower of compaction time measure at a fixed transmem-brane pressure Pure water flux of CA/PU blend membranes with diverse concentrations of PVP fromwt% was observed to inhance with increase in PVP concentration The PWF increased and this may be ascribe to leaching out of swelling agent, PVP, from nascent membrane to the coagulation bath . PVP is a water-soluble polymeric additive and it is considered that it leached out in the gelation step, leaving the highly porous mem-branes with larger membrane pores and thereby raising the pure water flux at higher PVP concentration. This is also affirmed by the SEM photo-graphs.

Water content

Water content raised in the membranes, This is cause to bigger membrane pore size as contrasted with those with lower concentration of PVP and ascribed by the faster additive diffusion , PVP, from nascent membrane in to the gelation bath at higher PVP concentration. In adition, blend membranes hydrophilicity increases with increase in PVP.

Effect of pH

The pH of basic solution of different concentrations with 2 wt.% PVA is varied to consider the permeate flux and percentage rejection. The change in the pHinhanced the intermolecular forces between the negative ions thereby improves the rejection through membrane. As the pH of the ions solution increases, the permeate flux declines and the rejection increases for different concentration of ions