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A parametric study for the preparation of chitosan membrane

As one of the most abundant naturally occurring polymers, chitosan has been drawing extensive attention because of its outstanding chelating and biological properties, showing great potential in water purification, pharmaceuticals, and food industrials. In addition, chitosan can function as a facilitated membrane for the separation of olefin and paraffin because it can easily form Ag+ containing chitosan chelate membranes, in which olefins can complex with Ag+ and then diffuse through the membrane while paraffins cannot form complexions thus achieving separation. Generally, chitosan is insoluble in water and other conventional organic solvents. However, since the amino group can be protonated in acid environment, chitosan dissolves in various aqueous acidic solutions. Generally dilute aqueous acetic solution is commonly used to dissolve chitosan and prepare the casting solutions for membrane preparation. After evaporation, protonated chitosan membrane is still soluble in water, which is undesirable from a point of view of the applications. Thus, the protonated chitosan membrane was treated using alkaline-alcohol solutions for neutralization to form a water-insoluble membrane, where the use of alcohol is to prevent the membrane from dissolving. To confirm a complete neutralization of the protonated membrane, the researchers usually use a sufficient long time for alkaline-alcohol treatment. However, a long membrane preparation period is undesirable industrially because it may make the whole process less economic. So a study on the alkaline-alcohol treatment for chitosan membrane preparation is necessary, while there is seldom such studies. Thus, in this project, a parametric study on the alkaline-alcohol neutralization process was conducted to improve the efficiency of membrane preparation process. In this research, chitosan powders were dissolved into acetic acid solution to form a homogeneous polymer solution, and certain amount of the membrane casting solution was poured into a petri dish followed by evaporation to form a dry membrane. a series of aqueous alkaline-alcohol treatment solutions were prepared by dissolving certain amounts of sodium hydroxide in a mixed solution of water and ethanol (or methanol) at different ratios, and the protonated dry membranes were immersed in the alkaline-alcohol solutions for different times for neutralization. After neutralization, the membranes were stored in deionized water and a UV-vis spectrophotometer was used to detect whether there existed any components leaked from the membrane in the storage solution. It was found that high sodium hydroxide concentration and a high volume percentage of water could increase the efficiency of alkaline treatment, that is, less time required to completely neutralize the membranes. However, a completely alcohol-free condition is unsuitable as some polymers would leak from the membrane matrix during membrane neutralization.