Carbonized template silica membranes for wetland saline water desalination

Environment, Water

Wetland water is one of the surface water sources that commonly found in a tropical ecosystem and have characteristic to contain high amount of natural organic matter (NOM). In Indonesia, wetland area are estimated as 33. 39 million ha which 60% are classified as tidal and spread in Sumatera, Papua and Kalimantan.

Kalimantan peoples who live surrounding wetland area was forced to using wetland water for household needs although the quality still doesn’t meet WHO standard. Moreover, the poor quality of wetland water was occurred when hot season due to increase of salt concentration in wetland water by sea water intrusion. Therefore, the water becoming more saline called wetland saline water. To providing the fresh water, desalination is necessary as alternative technology for that issues. In recent years, membrane processes have been considered for desalination.

Moreover, NOMs in wetland water is one of major pollutants in surface water [6]. Previous study was reporting the membrane technology was capable for treating wetland water via ultrafiltration (UF) by polysulfone membrane. However, membrane technology have a limitation for treating water with high NOM content. Yunos, et al. was found NOM have contributed to fouling on polysulfone membrane and led the water flux decrease drastically on UF process for treating surface water. Pervaporation is a technology for desalination of saline water which promise to produce fresh water with low energy consumption and give high water flux better than reverse osmosis. Commonly inorganic membrane (i. e. alumina, zeolite and silica) more widely used for pervaporation. Silica membrane is offering high molecular sieving

compared zeolite and organic materials, thermal resistance and robustness for desalination process. Silica membranes were synthesis via sol-gel method .

Silanol (Si-OH) group was forming by sol-gel process by adding acid catalyst at partial hydrolysis reaction and produce microporous silica thin film with pore sizes < 1 nm. Silanol has hydrophilic properties, when it was contacted with H2O molecules, the silica matrices will collapse. In order to improve the hydro-stability of silica membrane, previous studies have been conducted by carbonized template to silica matrices. Carbon template improved the hydrophobicity of silica membrane and provides a hindrance for the diffusion of unstable silanol group. Recent advances have shown that these carbon template silica membranes can be synthesis without interlayers. Instead of conventional silica membranes with interlayers, thus reducing the cost of silica membrane fabrication.

Other than that, silica membrane preparation method is usually done via conventional thermal processing (CTP) method similar to Elma, et al. work. Generally, CTP method spent 2 days/layer for drying, heating and cooling rates, and calcination, so that implies to costly. The innovative concept was demonstration by rapid thermal processing (RTP) method for preparation silica membrane to speed up overall time processing. It takes less than 1 day to fabrication of silica membrane compare to CTP. Hence, in this work we selected interlayer-free carbon template silica membranes (Si-P123) by RTP method and investigate their performance for desalination of wetland saline water.