

Sansaporn Plangsri 2014: Development and Implementation of Chitosan Membrane for Microbial Fuel Cell. Master of Engineering (Chemical Engineering), Major Field: Chemical Engineering, Department of Chemical Engineering. Thesis Advisor: Mr. Maythee Saisriyoot, Dr.techn. 143 pages.

Proton exchange membrane (PEM) for microbial fuel cell (MFC) was synthesized from chitosan. Glutaraldehyde and sulfosuccinic acid were used as crosslinking agents in order to improve its ultimate tensile strength and proton conductivity. 3-chloro-2-hydroxypropyl trimethylammonium chloride (Quat-188) was also employed for quaternization to develop antimicrobial activity of chitosan. Results showed that proton conductivity of chitosan membrane was enhanced with the content of sulfosuccinic acid. The highest proton conductivity and ultimate tensile strength (7.84×10^{-6} S/cm and 6.698 MPa, respectively) were obtained when 0.6 mole ratio of sulfosuccinic acid was employed. The additional positive charge from quaternization was determined by zeta potential, it was found that the zeta potential value increased with the reaction time. The morphology change of microorganism that contact with the surface of quaternized chitosan membrane was verified by SEM, it was shown that the morphology of microorganism were damaged and the extent of damage increase with the positive charge density, this might imply that the interaction between positive charge on quaternized chitosan membrane and negative charge on the outer membrane of microorganism leads to changes in the cell membrane structure. However, the high positive charge density result was not only high antimicrobial property, but also significant swelling of the quaternized chitosan membrane and therefore the strength of membranes was lost. From those results, the optimum reaction time in quaternization process should not be more than 4 h. Finally, proposed chitosan membrane was tested with dual chamber microbial fuel cell which graphite felts used as electrodes yielding R_{ohm} equal to 170 ohm at 72 h of incubation time.

Student's signature

Thesis Advisor's signature