Molecular imprinted polymer for β-carotene for application in palm oil mill effluent treatment

ABSTRACT

Palm oil mill effluent (POME) is one of the most significant pollutant in the form of wastewater. It could have negative effects on the environment include the emission of biogas and water pollution which comes from discharging the brownish tick POME to the water bodies if not properly managed. Discharge of dark brownish colored of POME directly into water bodies may affect the aquatic life as it will reduce sunlight penetration and suppress the photosynthetic activity. A molecularly imprinted polymer (MIP) for removal of β-carotene from POME has been aimed to develope in this study. The preparation of β-carotene imprinted and non-imprinted polymer (NIP) involves polymerization of β-carotene (or without it) with β-cyclodextrin (β-CD), 9-vinylcarbazole (9VC), tolylene diisocyanate (TDI) and N,N-dimethylformamide (DMF) as the monomer, co-monomer, cross-linker and solvent (porogen), respectively. Analysis from FTIR showed that MIP and NIP have similar characteristic peak with different peaks intensity, indicating the similarity in the backbone structure of polymerization. TGA result displayed high thermal stability with final decomposition at 320 °C for MIP-β-CD-9VC as compared to NIP-β-CD-9VC. The pH study shows that sorption of β-carotene increased with decreasing the pH of POME and the maximum sorption capacities achieved at pH 2 were 10 μg/g and 7 μg/g for MIP-β-CD-9VC and NIP-β-CD-9VC, respectively. The maximum sorption achieved by using 500 mg of MIP as the sorption of β-carotene increased with increasing the dosage of MIP. Kinetic model evaluation has been applied on this prepared materials. The sorption equilibrium data was well described by Freundlich model. The results indicated that the sorption of β-carotene on MIP follows a pseudo–second–order kinetic.

Keyword: β-Carotene; β-Cyclodextrin; Molecular imprinted polymer; Palm oil mill effluent