Iran Polym J (2014) 23:679–687
DOI 10.1007/s13726-014-0262-7

ORIGINAL PAPER

Preparation and evaluation of chiral selective cation-exchange PMMA–PNIPAm thermal-sensitive membranes

Yinlin Lei · Fei Chen Dr. · Yunjie Luo

Received: 27 January 2014 / Accepted: 22 June 2014 / Published online: 24 July 2014

Abstract Selective cation-exchange membranes are placing a key role in separation processes. The application of selective cation-exchange membranes is wide since there are many kinds of mixtures needed to be separated for reuse. In this study, a facile and efficient one-pot approach was used to obtain monodispersed methyl methacrylate–*N*-isopropyl acrylamide (MMA–NIPAm) polymer by atom transfer radical precipitation polymerization (ATRPP) and then MMA–NIPAm chiral selective separation membranes were prepared for separating racemic equol. Firstly, using dodecylbenzenesulfonyl chloride (DBSC) as the initiator, bipyridine (bipy)/CuCl as the catalyst system, acetonitrile as the solvent, and S-equol as template molecule by which a MMA–NIPAm copolymer was synthesized and it was characterized by TEM, FTIR, TGA, UV–vis absorption spectrum, and dynamic layer scattering analysis. Lastly, MMA–NIPAm chiral separation membranes were prepared by casting 3 wt% of MMA–NIPAm copolymer dimethyl formamide (DMF) solution on a rimmed glass plate and evaporated the solvent completely at 100 °C under vacuum. Then, the PMMA–PNIPAm chiral selective cation-exchange membranes were prepared by immersing in methanol/acetic acid (95:5, *v/v*) to remove the template molecules. Most worthy of mention was that the prepared chiral selective separation membranes could separate S-equol and R-equol from the mixture of racemic equol. In application of a thermo-responsive monomer, the separation ability of the prepared PMMA–PNIPAm chiral separation membranes could be tunable according to environment temperature changes.

Keywords PMMA–PNIPAm · Chiral · Membranes · ATRPP · (*R*, *S*)-Equol

Y. Lei · F. Chen Dr. (✉) · Y. Luo
School of Biotechnology and Chemical Engineering, Ningbo Institute of Technology, Zhejiang University, Ningbo 315100, People's Republic of China
e-mail: chenfeio1@163.com

Introduction

Equol is one of the main components of the soy isoflavones, which is known as the effect of anti-oxygen and estrogen. Turner et al. discovered that equol could eliminate kinds of freedom group with superior antioxidant properties when compared with all other isoflavones [1]. At physiological concentration in substrate, equol can reduce the rupture of DNA chain remarkably and the effect is more favorable than that of vitamin VC and vitamin E [2]. Equol is a chiral molecule that exists as the enantiomers *R*-equol and *S*-equol. *R*-equol and *S*-equol usually have different biological activities, so Muthyala's group tried first to separate the enantiomers of equol by chiral HPLC [3]. Soy proteins and isoflavones could affect bone mineral density in older women [4]. *S*-Equol has a high affinity for estrogen receptor but R-equol is far less active. So there is a developed method indeed to separate the enantiomers of equol. Alvira et al. conducted molecular modeling study on chiral separation of equol enantiomers by β-cyclodextrin [5]. The differential interactions between each enantiomer and the chiral host gave rise to different configurations for the corresponding inclusion of complexes. Therefore, a great priority has been given to the development of novel selective separation technologies [6, 7].

Molecular imprinting technology is a simple and effective method to prepare molecularly imprinted polymers (MIPs) with specific molecular recognition properties