An optical characterization of Tris(2-aminoethyl)aminocarboxylic acid Functionalized Polyvinylbenzyl Chloride Microspheres using polymer swelling

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Abstract

In this work, Tris(2-aminoethyl)aminocaboxylate functional group was attached chemically to the backbone of polyvinylbenzyl chloride which was lightly cross-linked with divinyl benzene.This ligand has a chemical structure similar to that of ethylenediamine tetraacetic acid (EDTA), as a common chelating agent for metal ions. These derivatized polymer microspheres were embedded in a hydrogel matrix of poly vinyl alcohol cross-linked with glutaraldehyde, which is optically characterized. The response is based on the interaction between the metal cations with the negative charges of the deprotonated carboxylate functional group, which led to neutralization of the charges and thus to polymer shrinking. As a result, an increase in the turbidity of the sensing membrane due to a change in the refractive index between the hydrogel and the derivatized polymer microspheres occurred. The changes in the turbidity of the sensing membrane were measured as absorbance using a conventional spectrophotometer. This sensing membrane responded selectively to Cu^{2+} solutions of different concentrations range ($1x10^{6-}$M to $1x10^{4-}$ M). It is found that Cu^{2+} bind to the demonstrated functionalized-polymer with formation constant of 1×10^5 M^{-1}.

References:

1. Shakhasher, Z.; Odeh, I.; Rajabi, I.; Khatib, M. “Optical sensing properties of dithiocarbamate functionalized microspheres, using a polyvinylpyridine-polyvinylbenzyl chloride copolymer”. Sensors, 2010, 10, 8953-8962.
2. Odeh, I.; Siam, S.; Khatib, M.; Shakhasher, Z.”An optical chemical sensor based on polymer swelling and shrinking using dithiocarbamate-polymer microspheres”. Jordan J. Chem. 2009, 4, 55-64.
3. Shakhasher, Z., Odeh, I., Jabr, S., Seitz, W.R. “An optical chemical sensor based on swellable dicarboxylate functionalized polymer microspheres for pH copper and calcium determination”. Microchimica. Acta, 2004, 144, 147- 153.