Abstract

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Project Title : Electrospun fibers from pyrene-functionalized copolymers for ferric ion detection

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Abstract:

Monitoring iron traces in food and water samples is of great interest as high levels of ferric ion may induce various biological disorders and become toxic for organisms. Fluorescence technique was chosen as analytical tool due to its simplicity and sensitivity. Fluorescence quenching-based sensing membranes for Fe^{3+} detection were prepared using pyrene as a fluorescent indicator embedded in a polymer matrix. The quenching of fluorescence is most likely due to interactions of electron-rich dye, pyrene, and electron-deficient quencher, Fe^{3+}, via a photoinduced electron transfer mechanism and/or electronic energy transfer. Two sensing materials were prepared. The first materials were electrospun fibers from poly(methyl methacrylate) (PMMA), poly(vinyl chloride-*co*-vinyl acetate-*co*-vinyl alcohol) and pyrene. The fibers showed good sensitivity toward Fe^{3+} with the ratio of fluorescence intensities before and after immersion in 1.0 mM Fe^{3+} solution (F_0/F) of 1.36. The second materials were solvent-cast membranes from polyvinyl chloride (PVC) and PVC-*graft*-polystyrene (PS). The membrane prepared from PVC-*g*-PS showed higher sensing abilities than that from PVC with the F_0/F value of 1.39. This could be due to pi-pi stacking between the phenyl side chains of PS and pyrene, which facilitated the interaction between pyrene and Fe^{3+}. In addition, introduction of porous structures to PVC membrane also enhanced the sensing performance. All prepared materials exhibited highly sensitive and selective responses toward Fe^{3+} over other selected metal ions. Moreover, a good reversibility of quenching and regeneration was obtained.

Keywords : Electrospinning, Fibers, Grafting, Polyvinyl chloride, Porous materials