Intensity and Lifetime Based Sensing of Fe(III) with Electrospun Nanosensors

M. Z. Ongun1, K. Ertekin2, S. Aydogdu2, D. Mercan3, O. Oter2, E. Cetinkaya4,5

1 University of Dokuz Eylul, The Graduate School of Natural and Applied Sciences, Department of Chemistry, 35160, Izmir, Turkey
2 University of Dokuz Eylul, Faculty of Sciences, Department of Chemistry, 35160, Izmir, Turkey
3 University of Ege, Faculty of Sciences, Department of Chemistry, 35100, Izmir, Turkey
4 University of Dokuz Eylul, Faculty Engineering, Department of Metallurgical and Materials Engineering, 35160, Izmir, Turkey
5 University of Dokuz Eylul, Center for Fabrication and Application of Electronic Materials (EMUM), 35160, Izmir, Turkey

merve.zeyrek@deu.edu.tr, kadriye.ertekin@deu.edu.tr, ozlem.oter@deu.edu.tr, engin.cetinkaya@ege.edu.tr, erdal.celik@deu.edu.tr

In this study, the use of electrospun nanofibrous materials as highly responsive fluorescence quenching-based iron (III) sensitive chemosensor is reported. Poly (methylmethacrylate) was used as polymeric support materials. Sensing slides were fabricated by electrospinning technique. Fe (III) sensors based on the change in the fluorescence signal intensity of fluoroionophore; 2-[(E)-[4-bromo-2,6-dimethylphenyl]imino]methyl]phenol (MS-4) (See Figure 1).

The fluorescence was distinctly quenched in the presence of Fe (III) at 395 nm and 440 nm for PMMA based thin film and nanofiber, respectively. The sensor slides exhibited high sensitivities due to the high surface area of the nanofibrous membrane structures. The preliminary results of Stern-Volmer analysis show that the sensitivities of electrospun nanofibrous membranes to detect Fe (III) ions are 6 fold higher than those of the continuous thin films. By this way we obtained linear calibration plots for Fe (III) ions in the concentration range of 10^{-3}-10^{-4} M. The response times of the sensing slides were less than one minute. In sensor design, sensor response, stoichiometry of possible complex between the fluoroionophore and metal cation, possibility of regeneration, detection limit, linear working range and lifetime were defined by using absorption and emission based spectrophotometric techniques.

Figure 1. Chemical structure of MS-4 dye

KEYWORDS: electrospinning, optical nanosensor, time resolved fluorescence, iron (III) sensor

REFERENCES: