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Direct evidence of advantage of using nano-sized zeolite beta for ISFET based biosensor construction

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Analytical characteristics of urease and butyryl cholinesterase based ISFET (ion sensitive field effect transistor) biosensors were investigated by the incorporation of zeolite Beta nanoparticles with varying Si/Al ratio. The results obtained by the zeolite modified ISFET transducers suggested that the Si/Al ratio strongly influenced the biosensor performances due to the electrostatic interactions between enzyme, substrate, and zeolite surface as well as the nature of the enzymatic reaction. Using relatively small nanoparticles (62.7 ± 10 nm, 76.2 ± 10 nm, and 77.1 ± 10 nm) rather than larger particles, that are widely used in literature, allow us to produce more homogenous product which will give more control over the quantity of material used on the electrode surface and ability to change solely Si/Al ratio without changing other parameters such as particle size, pore volume and surface area. This should enable the investigation of the individual effect of changing acidic and electronic nature of this material on the biosensor characteristics. According to our results, high biosensor sensitivity is evident on nanosize and sub-micron size particles, with the former resulting in higher performance. The sensitivity of biosensors modified by zeolite particles is higher than that to the protein for both types of biosensors. Most significantly, our results show that the performance of constructed ISFET type biosensors strongly depends on Si/Al ratio of employed zeolite Beta nanoparticles as well as the type of enzymatic reaction employed. All fabricated biosensors demonstrated high signal reproducibility and stability for both butyrylcholinesterase (BuChE) and urease.

Biography

Esin Soy has completed her M.Sc. degree at the age of 25 years from Middle East Technical University, Micro and Nanotechnology Department and currently is a Ph.D. student in University of Illinois at Chicago. She is working in the area of biosensing and surface science.

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