Sensing based on the motion of enzyme-modified nanorods

Asymmetric modification with an enzyme confers nanorods an enhanced diffusive motion that is dependent on the concentration of the enzyme substrate. In turn, such a motion opens the possibility of determining the concentration of the enzyme substrate by measuring the diffusion coefficient of nanorods modified with the appropriate enzyme. Nanorods, with a Pt and a polypyrrole (PPy) segment, were fabricated. The PPy segment of such nanorods was then modified with glucose oxidase (GOx), glutamate oxidase (GluOx), or xanthine oxidase (XOD). Calibration curves, linking the diffusion coefficient of the oxidase-modified nanorods to the concentration of the oxidase substrate, were subsequently built. The oxidase-modified nanorods and their calibration curves were finally used to determine substrate concentrations both in simple aqueous solutions and in complex samples such as horse serum and cell culture media. Based on the obtained results we are confident that our motion-based approach to sensing can be developed to the point where different nanorods in a mixture simultaneously report on the concentration of different compounds with good temporal and spatial resolution.

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