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Development of enzyme sensors based on the gas permeation with the use of a hollow fiber membrane

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ABSTRACT

A novel enzyme sensor based on the gas permeation with the use of a hollow fiber membrane was developed and the device was applied to flow-injection analysis (FIA) of urea with an acid urease column as a recognition element. A flow-type of the biosensing system used in this study was assembled with a sample injection valve, a gas-diffusion device with an immobilized acid urease, and a flow-through cell attached to a UV/VIS detector. The gas-diffusion device has a double tubing structure. The inner tubing was gas permeable tubing which was a hollow fiber membrane, and bromothymol blue as a coloring agent was pumped through in this tubing. The outer tubing was fused silica capillary for flowing carrier solution and a monolithic silica column was constructed between inner and outer tubing. An acid urease was immobilized by using of glutaraldehyde crosslinking method onto the silica monolith followed by alkylamination of the constructed monolithic silica. Standard urea solutions were measured through monitoring variations in absorbance resulting from pH shift due to CO_2 molecules enzymatically generated in acidic condition. A wide, linear relationship was obtained between the concentration of urea (1.25–1,000 μM) and the change in absorbance. This FIA systemgave higher sensitivity than that previous system did (25–500 μM). The proposed FIA system was applied to determination of urea in skin toners as real samples.

Keywords: Acid urease; Enzyme sensor; Flow-injection analysis; Hollow fiber; Silica monolith

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