Active surfaces engineered by immobilizing protein-polymer nanoreactors for selectively detecting sugar alcohols

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We introduce active surfaces generated by immobilizing protein-polymer nanoreactors on a solid support for sensitive sugar alcohols detection. First, such selective nanoreactors were engineered in solution by simultaneous encapsulation of specific enzymes in copolymer polymersomes, and insertion of membrane proteins for selective conduct of sugar alcohols. Despite the artificial surroundings, and the thickness of the copolymer membrane, functionality of reconstituted Escherichia coli glycerol facilitator (GlpF) was preserved, and allowed selective diffusion of sugar alcohols to the inner cavity of the polymersome, where encapsulated ribitol dehydrogenase (RDH) enzymes served as biosensing entities. Ribitol, selected as a model sugar alcohol, was detected quantitatively by the RDH-nanoreactors with GlpF-mediated permeability in a concentration range of 1.5–9 mM. To obtain “active surfaces” for detecting sugar alcohols, the nanoreactors optimized in solution were then immobilized on a solid support: aldehyde groups exposed at the compartment external surface reacted via an aldehyde-amino reaction with glass surfaces chemically modified with amino groups. The nanoreactors preserved their architecture and activity after immobilization on the glass surface, and represent active biosensing surfaces for selective detection of sugar alcohols, with high sensitivity.
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