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Sol-Gel Hybrid Materials Applied As Matrices For A Co-Immobilized System of Bacteria and Algae

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ABSTRACT

Sol-gel hybrids containing different quantity of algal polysaccharide were synthesized, characterized and used as matrices for immobilization of bacterial and algal cells. Cell-cell interaction in the prokaryote - eukaryote model of the unicellular microalga Scenedesmus acutus and bacterium Bacillus sp. UG-5B jointly immobilized in the hybrid material was evaluated. BET analyses revealed that introduction of polysaccharide and formation of a hybrid structure leads to a decrease in the surface area but to an increase in the pore size of the matrices. This matrix feature is inversely correlated with the enzyme activity of the bacterial strain. The use of hybrid sol-gel matrix for encapsulation of bacterial and algal cells was followed to prove its applicability for the synthesis of the enzyme nitrilase and the accomplishment of a nitrile degradation process. Sharp increase in the enzyme activity of the encapsulated bacteria was registered compared to this of the free cells when 5% of polysaccharide was included as an organic part. In the co-immobilization procedure performed, the symbiotic relationship of the bacterium and the algae are used to increase oxygen transfer rate to the bacteria by co-immobilizing it with algae for further increasing the enzyme production and 4-nitrobenzonitrile degradation.

Keywords: sol-gel method; algal polysaccharide; cell co-immobilization, 4-nitrobenzonitrile biodegradation