MAGNETIC MODIFICATION OF PROTEINS AND OTHER SENSITIVE BIOMATERIALS AT SUBZERO TEMPERATURES

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Abstract

Simple, gentle and low-cost procedure for magnetic modification of sensitive and labile non-magnetic biomaterials has been developed. Magnetic iron oxides nano- and microparticles prepared by microwave-assisted synthesis from ferrous sulfate have been successfully applied for direct magnetic modification under low temperature in a freezer. These conditions have enabled magnetization of biological materials such as plant and seagrass based materials, enzymes immobilized on non-magnetic carriers (lipase on cellulose powder and commercial glucose isomerase) and cross-linked powdered proteins (enzymes trypsin and lipase), while keeping substantial part of their activity. Previously published methods, e.g. those based on the treatment by perchloric acid stabilized magnetic fluid, on the microwave irradiation of the treated material in the presence of ferrous sulfate at high pH or on the direct treatment of non-magnetic material by microwave-synthesized magnetic iron oxides nano- and microparticles at elevated temperature are mainly suitable for stable non-magnetic inorganic or organic materials. In this study, subzero temperatures used for the fixation of magnetic particles on the surface or in pores of magnetized material can overcome the steps incompatible with sensitive materials and biologically active compounds. All prepared materials had rapid response to a permanent magnet and magnetic particles did not release from material during storage in suspension at least for two months. Generally, both magnetized immobilized enzymes and cross-linked powdered enzymes were stable during eight repeated reaction cycles nearly without the loss of enzyme activity. This smart method can be an inspiration as a possibility for magnetic modification of other types of sensitive biomaterials.

Keywords: Magnetic iron oxides particles; microwave-assisted synthesis; low-temperature magnetic modification; biomaterials; immobilized enzymes

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