The immobilization of ficin, a nonspecific plant protease, for the biomedical applications as a wound-healing agent

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The enzymatic treatment of wounds by various proteases like trypsin, chymotrypsin, collagenase, papain etc. is widely used in medicine as a wounds-cleaning therapy to speed up wounds healing. Recently we have shown that Ficin, a nonspecific plant protease from the Ficus tree, efficiently eradicates staphylococcal biofilms increasing thereby the efficacy of antibiotics, and exhibits attractive wound healing activity. We aimed to produce a series of Ficin preparations immobilized on a various carriers for enzyme stabilization during storage and application.

A virtual screening of high-affinity carriers for immobilization has been performed using computer modelling. Based on the comparative analysis of the total energy and the localization of the ligand binding sites, some assumptions about the enzyme interactions with suggested carriers were made. A number of heterogeneous enzyme preparations have been offered and the structural features of these complexes were predicted. The Ficin adsorption on chitosan, cation (VION KN-1) and anion (VION AN-1) exchange fibers allowed preserving up to 70 % of the catalytic activity. Being immobilized on chitosan, the enzyme stability was increased 10-fold in compare with soluble protein. While the biofilm matrix hydrolysis by immobilized enzyme was less in compare with the soluble Ficin, an overall the antibiofilm activity of the chitosan-immobilized Ficin was higher because of mechanical removal of the biofilm matrix form the surfaces in vitro. Neither soluble nor immobilized Ficin and carriers did not exhibit any mutagenic, DNA-damaging, or cytotoxic activity, suggesting them as perspective start points for development of the staphylococcal biofilms treatment therapies.

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