ENZYME SHIELDING IN A SOFT ORGANO-SILICA LAYER – PHARMA/BIOPHARMA APPLICATIONS

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Enzymes, or biocatalysts, are specialty proteins. Like antibodies to antigens, enzymes exhibit remarkable specificity for their substrate and naturally facilitate many chemical conversions. However, the use of enzymes in the biotech industry ($2.3bn) is strongly limited by the fact that enzymes are highly sensitive like most proteins and usually not fitted to in vivo and process conditions. Many expensive genetically engineered or biosourced enzymes show remarkable properties but need to be made more robust for deployment in the health industry.

We have developed a unique procedure to fit enzymes to in vivo and process conditions. The process is initiated by immobilizing any enzyme or cocktail of enzymes onto safe silica particles (Step 1 on Figure 1) and protect them by growing a nano-structured shield on the outer surface of the particle (Step 2 on Figure 1). This formulation of enzymes provides them with remarkable resistance to in vivo and process conditions, such as acidity, temperature, presence of chaotropic agents, proteases, solvents, etc.

![Figure 1. Enzyme shielding in a organo-silica layer](image)

We show a number of pharma and biopharma applications of this enzyme-shielding technology, ranging from the improvement of protein digestion in bioanalysis, to the feasibility of biocatalysis in the presence of organic solvents or enzyme-mediated bioconjugation.