Polymer – lipase complexes as biomaterials

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One of the modern methods of polymer and biological chemistry, nanotechnology and biotechnology is the method of enzyme immobilization in polymeric environment or at the interfaces. Such systems as polymer – enzyme complexes have several advantages that making them more convenient for the effective applications: increase stability of the enzyme in time and to various denaturing agent; more simple and rapid separation of the reaction medium; multiple usage etc.

The aim of this study was to prepare complexes of PE-240 and lipase from various sources possessing high catalytic activity for the further application as biomaterials.

The following reagents were used: lipase from porcine pancreas, triacylglycerols, Na-polystyrenesulfonate (PSS), polydiallildimethylammonium chloride (PAMA), copolymer based on polypropylene oxide (PE-240). The lipase activity was measured using the method of potentiometric titration on an automatic titrator of the “Radiometer” (Copenhagen). The enzyme activity was measured by the rate of hydrolysis of the substrate. The main advantages of this method are high accuracy, high sensitivity and the ability to carry out the titration in the more dilute solutions than it allows visual indicator methods.

It was found that the lipase activity in the PSS presence was higher than the control at 17% and 15% at a ratio of 1:10 and 1:100 (lipase:PSS). It can be explained by increasing of the microheterogeneity system due to the interaction of lipase with polyelectrolytes. At a ratio 1:1 the lipase activity was decreased to 77% due to the insufficient number of PSS for the formation of microheterogeneous systems.

In the presence of PAMA the lipase activity was decreased to 94% at a ratio 1:10 (lipase:PAMA). It can be explained by that the lipase is negatively charged at neutral pH during complex formation is located inside the globule of a positively charged polymer and becomes less accessible to substrate.

In the presence of PE-240 the lipase activity was decreased to 88% at a ratio 1:5 (lipase:PE-240) and was higher than the control at 12% at a ratio 5:1.

Thus, the lipase activity depends on polyelectrolyte parameters (molecular mass, charge, chain flexibility etc.) and ratio of polyelectrolyte to enzyme. The best systems are the following: lipase:PSS 1:10 and 1:100, lipase:PE-240 5:1 and 1:1, which are promising for application in bioengineering and biotechnology.

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