Optimization of synthesis conditions of biocatalytic systems on the base of alginate microspheres and glucose oxidase

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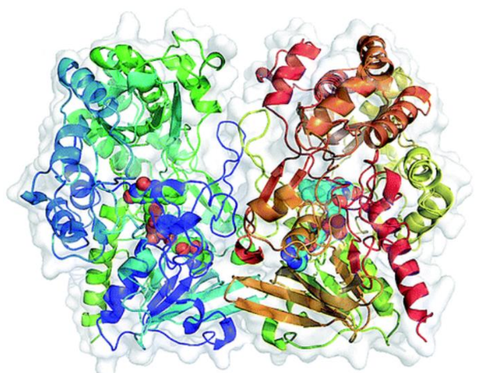
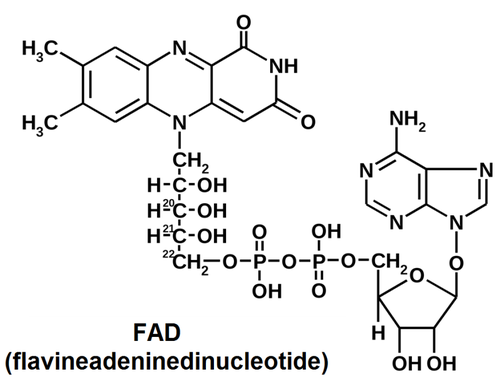
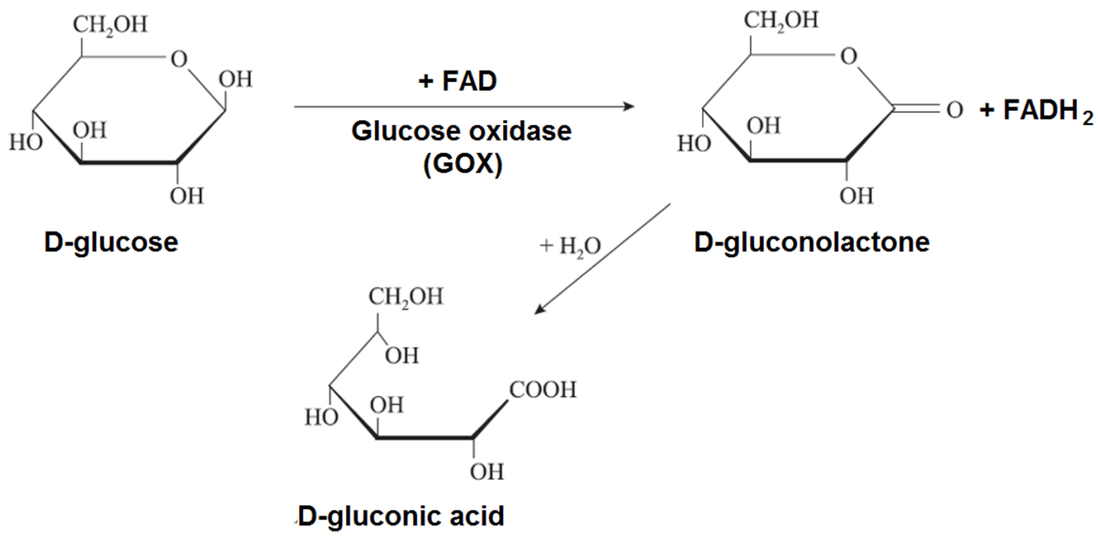
Glucose oxidase (E.C. 1.1.3.4)



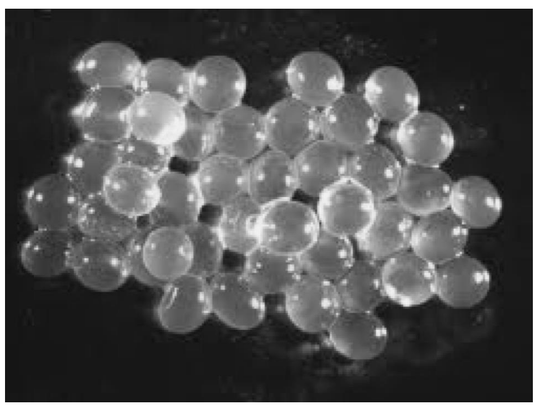


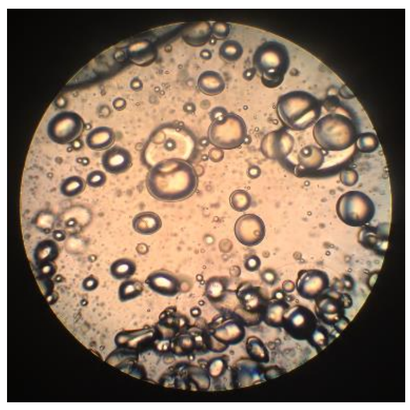
Catalyzed reaction



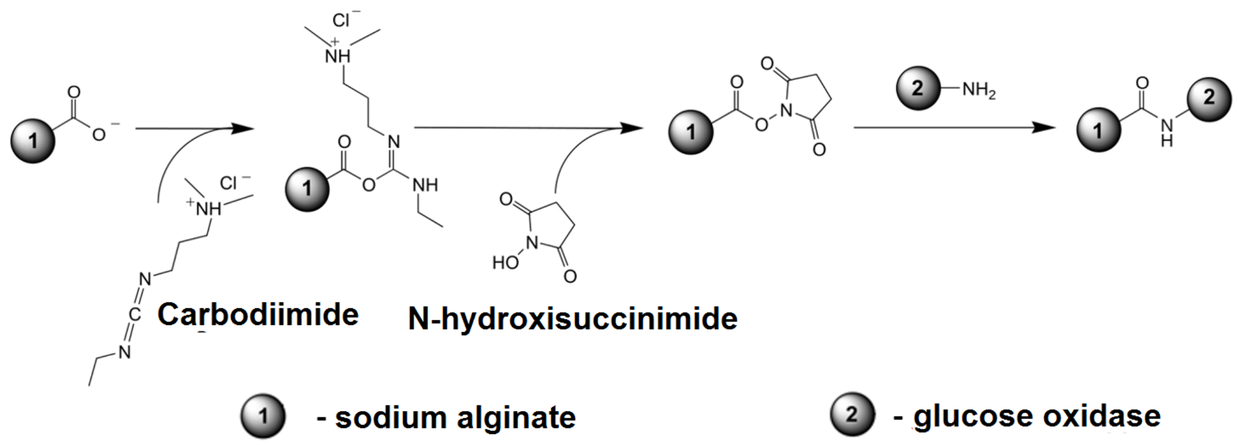
To immobilize glucose oxidase, two types of carriers based on sodium alginate were synthesized:

- **macrospheres with a diameter of 2-2.5 mm obtained by the drop method;**
- **microspheres obtained by emulsification and internal gelation**





Scheme of immobilization



GOX activity determination

Reaction mixture:

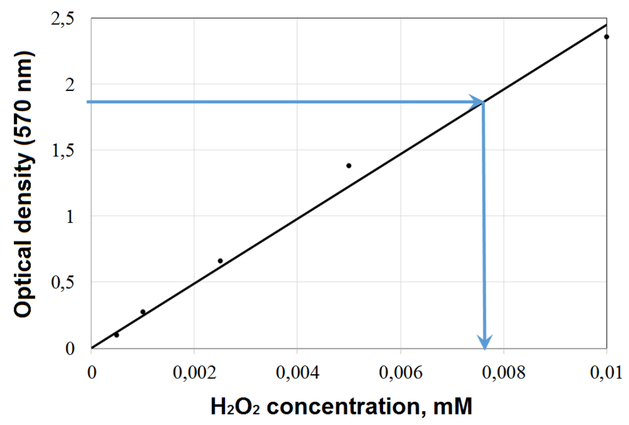
0,01 ml of investigated solution containing H_2O_2

2,0 ml of HCl solution

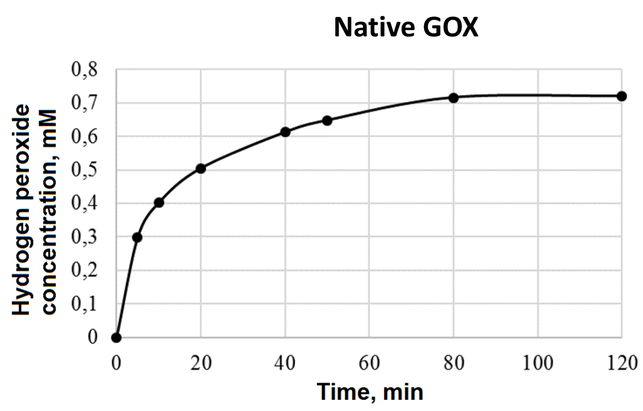
0,2 ml of KI solution

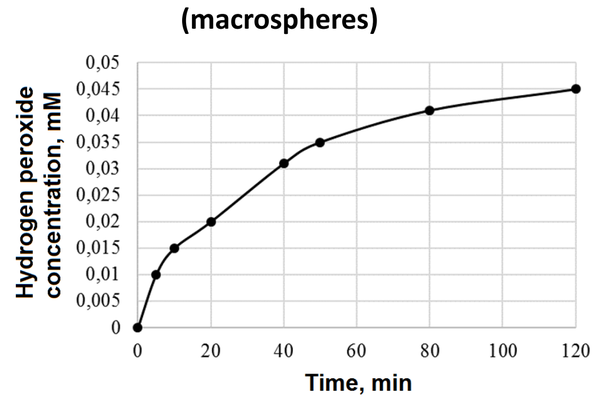
0,2 ml of ammonium molibdate solution

0,2 ml of starch solution



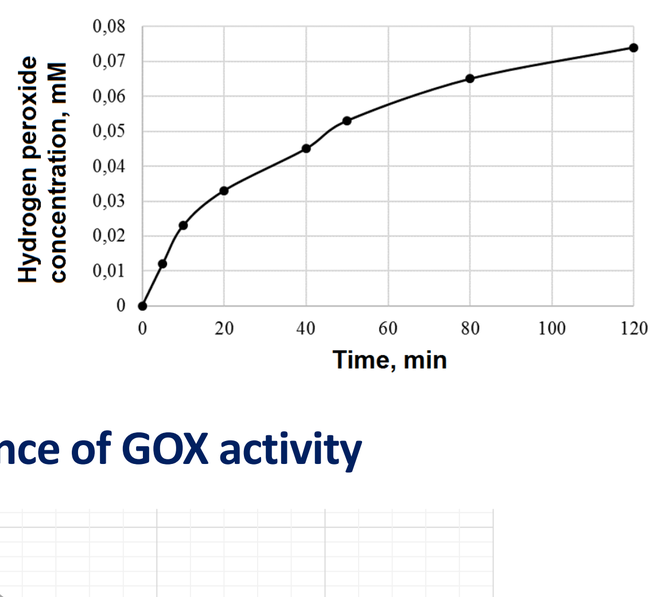
Comparison of native and immobilized GOX activity



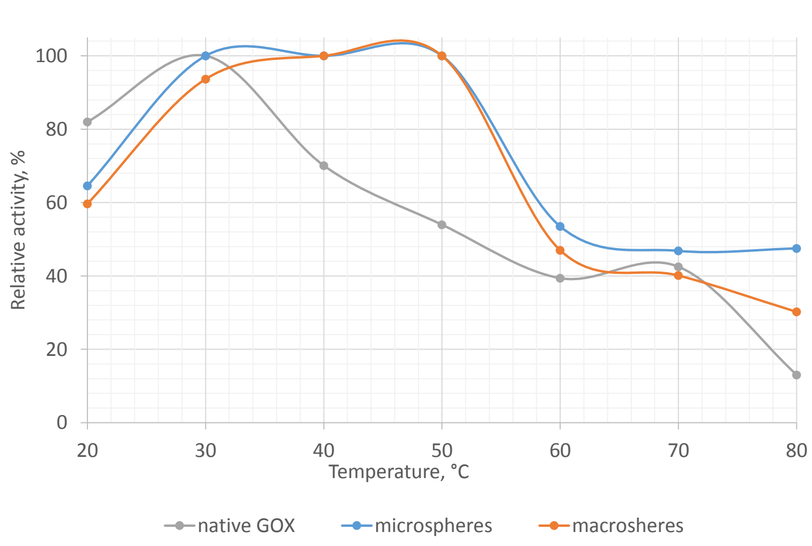


Kinetic parameters

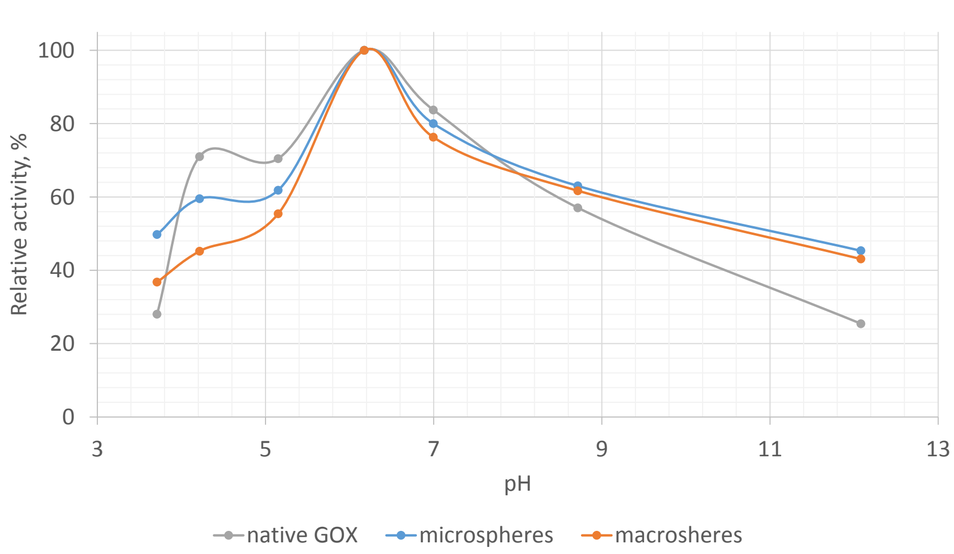
Parameter	Native GOX	Immobilized GOX (macrospheres)	Immobilized GOX (microspheres)
V_m, mM	0,58	0,18	0,24
Activity, U/mg	0,32	0,09 (28,1%)	0,11 (35 %)



Temperature dependence of GOX activity



pH dependence of GOX activity



It was found that immobilized glucose oxidase preparations have a slightly lower activity compared to its free form (by 20-30%). This is primarily due to the heterogenization of the process, as well as to the loss of the enzyme during immobilization. However, immobilization makes it easy to separate the enzyme from the reaction medium and reuse it, which compensates for the loss of activity with a single use. In addition, experiments have shown that immobilization on alginate micro- and macrospheres slightly expanded the optimal temperature and pH ranges in comparison with the soluble form of the enzyme, which indicates a higher resistance of the synthesized biocatalysts to inhibitory effects.

The developed biocatalysts can be used in the food industry as baking improvers, in the chemical industry for producing gluconic acid, and in analytical chemistry for determining the concentration of glucose. To increase the resistance of biocatalysts to inhibitory effects, micro-and macrospheres made of sodium alginate (polyanion) can be coated with natural polycations (for example, chitosan). Such systems can be used, in particular, as drug delivery systems to certain parts of the gastrointestinal tract.

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