

Magnetic Nanoparticles Coated with Modified Polysaccharides for the Immobilization of Glycoproteins

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Abstract : The most important proteins in human serum responsible for drug binding are human serum albumin (HSA) and α 1-acid glycoprotein (AGP). The AGP molecule is a glycoconjugate containing a single polypeptide chain composed of 183 amino acids (the core of the protein), and five glycan branched chains (sugar part) covalently linked by an N-glycosidic bond with aspartyl residues (Asp(N) -15, -38, -54, -75, -85) of polypeptide chain. This protein plays an important role in binding alkaline drugs, a large group of drugs used in psychiatry, some acid drugs (e.g., coumarin anticoagulants), and neutral drugs (steroid hormones). The main goal of the research was to obtain magnetic nanoparticles coated with biopolymers in a chemically modified form, which will have highly reactive functional groups able to effectively immobilize the glycoprotein (acid α 1-glycoprotein) without losing the ability to bind active substances. The first phase of the project involved the chemical modification of biopolymer starch. Modification of starch was carried out by methods of organic synthesis, leading to the preparation of a polymer enriched on its surface with aldehyde groups, which in the next step was coupled with 3-aminophenylboronic acid. Magnetite nanoparticles coated with starch were prepared by in situ co-precipitation and then oxidized with a 1 M sodium periodate solution to form a dialdehyde starch coating. Afterward, the reaction between the magnetite nanoparticles coated with dialdehyde starch and 3-aminophenylboronic acid was carried out. The obtained materials consist of a magnetite core surrounded by a layer of modified polymer, which contains on its surface dihydroxyboronyl groups of boronic acids which are capable of binding glycoproteins. Magnetic nanoparticles obtained as carriers for plasma protein immobilization were fully characterized by ATR-FTIR, TEM, SEM, and DLS. The glycoprotein was immobilized on the obtained nanoparticles. The amount of mobilized protein was determined by the Bradford method.

Keywords : glycoproteins, immobilization, magnetic nanoparticles, polysaccharides

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