The PhD Thesis is devoted to the magnetic catalyst for the conversion of plant polysaccharides into polyols.

Polyols are important feedstock for many fields of modern industry. Ethylene glycol, propylene glycol and mannitol are widely used in biotechnology, production of surfactants, lubricants, solvents, antifreezes, drugs. Thus, the polyols are characterized by the high demand. However, major processes for producing of polyols include the use of valuable or non-renewable hydrocarbon feedstocks. Therefore, it is important to look for new effective ways to produce polyols from cheap, renewable sources. For example, ethylene glycol and propylene glycol can be produced by hydrogenolysis of cellulose in subcritical water in the presence of heterogeneous catalysts. Mannitol is formed by hydrolytic hydrogenation of inulin.

To obtain high selectivity for the target products, an effective hydrogenation catalyst is needed to be developed. Platinum group metals show high catalytic activity in the conversion of cellulose, cellobiose, lignin and glucose. Heterogeneous ruthenium catalysts are the most promising for such processes.

Currently, reusable catalysts are interesting and relevant in chemistry and chemical technology. The use of particles with high catalytic activity supported on the materials with magnetic properties is an effective strategy. The use of such catalysts leads to significant progress in the development of novel efficient catalytic systems and methods for plant biomass processing.

Thus, it can be stated that the research aimed at the development of catalysts with magnetic properties for the conversion of plant polysaccharides into polyols is relevant and has scientific and practical significance.

The purpose of this work is the development of new heterogeneous ruthenium containing catalysts with magnetic properties and the study of their catalytic activity in cellulose hydrogenolysis and inulin hydrolytic hydrogenation processes.

To achieve this goal, the following tasks were solved:

- theoretical analysis and prediction of catalyst properties for cellulose hydrogenolysis and inulin hydrolytic hydrogenation;

- development of ruthenium containing catalysts of a new type with magnetic properties;

- conducting kinetic experiments and identifying the regularities of the studied catalytic transformations;

- physical and chemical studies of optimal magnetically separable catalysts;

- determination and optimization of reaction conditions ensuring maximum yield of basic conversion products;

- evaluation of stability of the developed catalysts under hydrothermal process conditions;

- mathematical modeling of the processes of hydrogenolysis of glucose and fructose in the presence of a magnetically separated catalyst;

- development of basic technologies for cellulose hydrogenolysis to glycols and hydrolytic hydrogenation of inulin to mannitol using a new catalytic system.

Scientific novelty. For the first time, magnetic Ru-containing catalysts were proposed for cellulose hydrogenolysis and inulin hydrolytic hydrogenation processes. As a support, mesoporous silica was chosen; magnetic properties of the catalyst were provided by magnetite nanoparticles uniformly distributed over the support surface. The catalyst seems to be stable under hydrothermal conditions and can be easily separated from the reaction mixture by an external magnetic field.

The method of synthesis of magnetic catalysts with the specified physicochemical properties was developed. The scientific basis of the technology of converting cellulose and inulin into polyols using magnetic catalysts were developed. Stability of catalysts in at least three consecutive cycles without reduction was shown. The effect of conversion parameters (temperature, reaction time, hydrogen partial pressure, stirring mode, Ru/substrate ratio, etc.) on the yield of target products was studied. Optimal process conditions were determined.

Practical significance. The work presents a method of synthesis of a new catalyst with magnetic properties. The developed catalyst seems to be effective for processes of cellulose hydrogenolysis and hydrolytic hydrogenation of inulin to

polyols. A method of processing cellulose into glycols with a total yield of up to 40% and inulin into mannitol with a yield of up to 44% was proposed.

The main thesis to be defended:

1) a procedure for the synthesis of a Ru-$Fe_3O_4$-$SiO_2$ catalyst shoving magnetic properties with a mass content of ruthenium of 1, 3, 5%,;

2) results of study of kinetic regularities of processes of cellulose hydrogenolysis and hydrolytic hydrogenation of inulin in the presence of magnetically separated Ru-$Fe_3O_4$-$SiO_2$ catalyst;

3) mathematical models of hydrogenolysis of glucose and fructose in the presence of a magnetically separated Ru-$Fe_3O_4$-$SiO_2$ catalyst.