Таким чином, в ході проведених випробувань було визначено ефективність флокулянту метацид при видаленні нафтопродуктів, що забезпечило ступінь вилучення 99%. Показано, що максимальну ефективність виявив флокулянт метацид при концентрації 2 мг/дм^3.

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BIOSORBENTS FROM SUGARCANE RESIDUES

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In recent years, an increasing interest in obtaining of sorbents based on renewable lignocellulosic plant sources is observed. Plant raw materials can yield efficient sorbents of inorganic and organic pollutants for water treatment. Agricultural residues and waste from the food industry are a promising source of biosorbents due to the presence of pores and of

functional groups on the surface [1, 2]. The main advantages of biosorbents over other traditional adsorbents are their annual renewal and low cost. Different researchers have investigated the sorption properties of various plant materials for heavy metals and for organic dyes [3-6].

Biosorbents can be chemically modified in order to obtain products with a larger number of functional groups and active sites. Various chemicals have been proposed, for example, organic and mineral acids, alkaline solutions, combined treatments, organic compounds, etc [7-10]. Solutions of acid are strong oxidizing agents that lead to polysaccharide hydrolysis and to the corrosion of equipment. Treatment with alkaline solution promotes the formation of additional active sorption sites but does not promote the increase in the surface area. The disadvantages of combined treatment are the multi-stage and the large water consumption. The application of organic compounds is connected with the use of additional chemicals. A promising method for obtaining biosorbents is the oxidative treatment of plant materials with hydrogen peroxide in acetic acid [11]. It is possible to obtain biosorbents with different contents of cellulose and lignin by varying the concentration of hydrogen peroxide. This leads to the oxidation and partial dissolution of lignin, and promotes the oxidation of polysaccharides into soluble products, and a porous structure is formed.

The aim of the research work was to study the effect of oxidative treatment on the structural and sorption properties of biosorbents from sugarcane residues.

The residues of sugarcane processing, i.e. bagasse and straw (tips and leaves), were used as a raw material. To prepare biosorbents, plant materials were treated with hydrogen peroxide in an acetic acid medium at different hydrogen peroxide content in solution (X_1), temperature (X_2) and time of the process (X_3). The yield, chemical composition of obtained materials and their sorption ability towards methylene blue was studied. The results of the investigation of efficiency of cationic dye removal from water solution are given as 3D-surfaces in Fig. 1.

Both sugarcane biomasses were easily delignified by hydrogen peroxide treatment in an acetic acid medium. Such treatment causes the removal of 47.9-53.7% material and results in the preparation of biosorbents of a white color indicating a low lignin content due to the delignification of biomass with peracetic acid which is formed as a result of an interaction of acetic acid with hydrogen peroxide. At the same time, the removal of different extractives also takes place.

Partial removal of the components of polysaccharide nature can also takes place. The yield and chemical composition of the biosorbents strongly depends on the treatment parameters as well as their sorption ability.

The greatest removal efficiency of methylene blue from water was 77.2% for a straw sorbent obtained by treating biomass with hydrogen peroxide of 10 vol. % at a high temperature for a long time. This can be due to the removal of most part of mineral components from straw that promotes the formation of a porous structure. It can be seen that increasing the hydrogen peroxide content, temperature and time leads to increase in the sorption properties of biosorbents to cationic dye.

The greatest efficiency of methylene blue sorption by both types of biosorbents is achieved after 150 min treatment at 90^{o}C with a hydrogen peroxide concentration of 10 vol.%. But, in case of biosorbent from straw, the obtained material shows the greatest sorption of organic dye after sugarcane straw treatment with a hydrogen peroxide concentration of 30 vol.%.

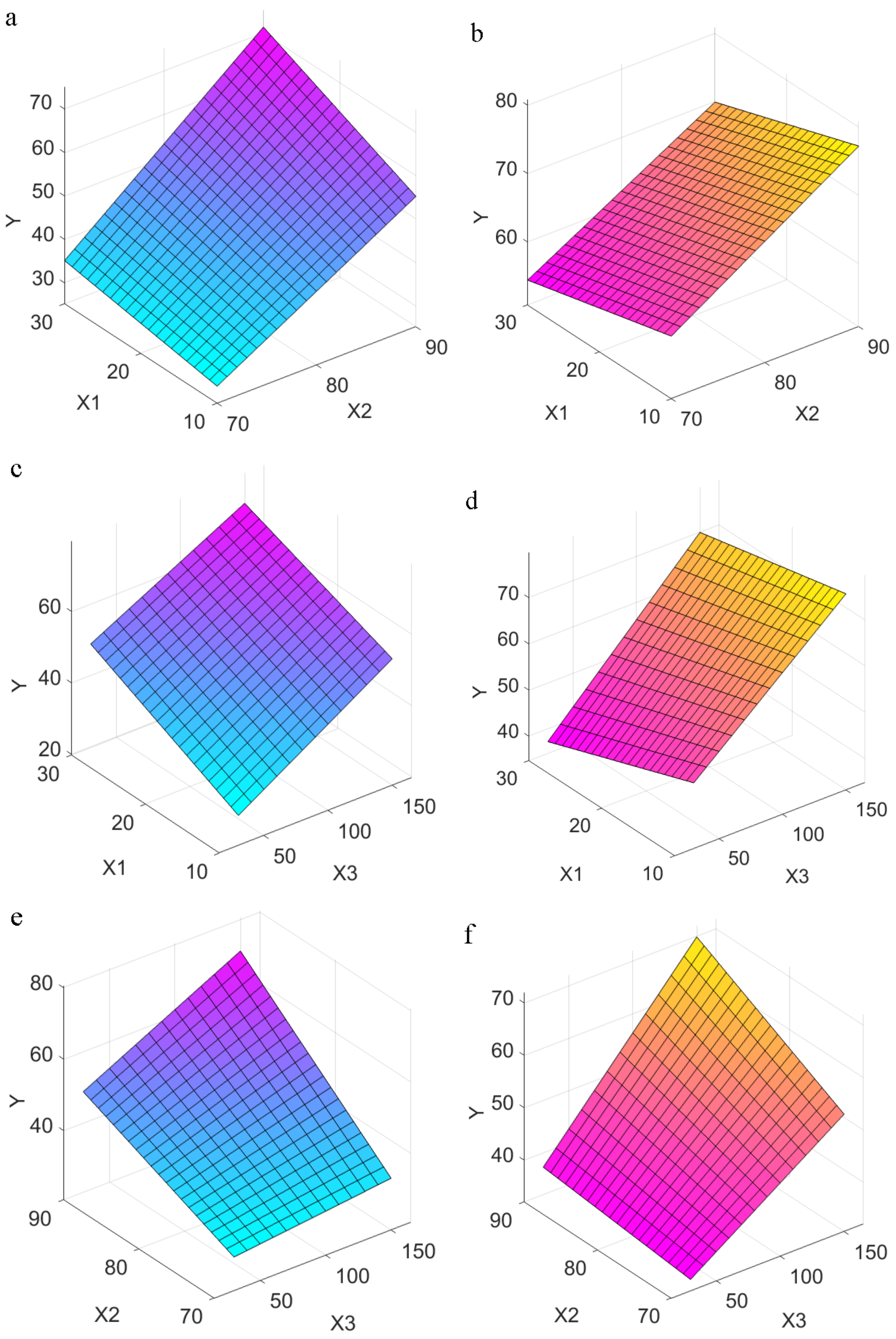

Figure 1. Surface plots of the effects of interactions on sorption ability of biosorbents from sugarcane biomass towards methylene blue:
a, b – X_1-X_2 / H_2O_2 content (vol. %) - temperature (°C) for bagasse and straw, respectively;
c, d – X_1-X_3 / H_2O_2 content (vol. %) – time (min) for bagasse and straw, respectively;
e, f – X_2-X_3 / temperature (°C) – time (min) for bagasse and straw, respectively

Thus, the efficient biosorbents was prepared from sugarcane residues. The treatment of s bagasse and straw with hydrogen peroxide gives cellulosic sorbents with different structural and sorption properties depending on the ratio of reagents. Comparison of the initial materials and prepared biosorbents demonstrated that the sorption ability of the both materials toward cationic dye depends on the treatment parameters.

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