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THE INFLUENCE OF TiO_2 MODIFICATION ON ITS ADSORPTION AND PHOTOCATALYTIC PROPERTIES

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Titanium dioxide is widely used in photocatalysis in particular for the destruction and mineralization of organic and inorganic pollutants. It is a cheap and non-toxic catalyst. The main factor controlling photoactivity of titanium dioxide is the high degree of recombination of photogenerated electrons and holes. But the electron-hole pair can also have an average lifetime that is sufficient for diffusion to the surface of the particles. This enhance photon absorption and increase the number of electron-hole pairs. On the other hand, the lifetime of an electron-hole pair can be affected by the number of recombination sites on the photocatalyst, which can be various impurities, defects of the crystal structure etc. Recently, great attention has been focused on the development of efficient catalysts based on TiO_2 and non-metal as dopants for the degradation of organic pollutants in aqueous medium.

In the current research, we synthesized a row of nanocomposites based on titanium dioxide, carbon and sulfur (TiO_2, C/TiO_2, S/TiO_2 and $C/S/TiO_2$) with different content of dopant (C or S). Photocatalytic activity of nanocomposites was evaluated through the degradation of cationic dyes Safranine T and Rodamin B under UV and visible irradiation, as model reactions. These dyes are stable in the environment.

The nanocomposites were characterized by X-ray diffraction, scanning electron microscopy, energy-dispersive spectrometry, transmission electron microscopy, Brunauer–Emmett–Teller and Barret–Joiner–Halenda methods, UV-vis diffuse reflection spectroscopy, Fourier transform infrared spectroscopy.

The content of anatase in our samples significantly exceeds the content of rutile. The shape of the peaks confirms the high crystallinity of the samples. The pure TiO_2 has an average particle size of 14 nm and it is decreased for composites up to 6-9 nm, which means that C and S additives inhibiting grain growth of TiO_2.

Analysis of nitrogen adsorption–desorption isotherms obtained at 77K for the synthesized samples shows the presence of a hysteresis loop. It was established that for all samples nitrogen sorption isotherms belong to type IV in accordance with IUPAC classification with H2 type of hysteresis loop, indicating that mesopores are present in the synthesized samples. It was found, that the specific surface area of nanocomposites is increased in 2-3 times compared with TiO_2. The absorption edge of composites is shifted to a shorter wavelength as compared with pure TiO_2, which is connected with a decreases in the optical band gap.

The composites showed higher activity compared to the pure TiO_2 under UV and visible irradiation. It was found the direct proportional dependence of the dye degradation rate and their adsorption value. The highest photocatalytic activity is observed at a powder concentration of 2 g/l and pH – 6-8. The activity of the photocatalysts was diminished after five use cycles. This decrease is related to losses of the photocatalyst during the experiment and blockage of the active sites by the reaction products.

So, the synthesized porous nanocomposites exhibited good photocatalytic activity compared to pure TiO_2 due to their highest specific surface, developed porous structure. It provides higher-efficiency transport for the reactant molecules, appearance of lattice defects and heterojunctions between the phases. It promotes the charge separation and increase their lifetime, thereby complicating the charge recombination

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THE INFLUENCE OF THE USE OF OXIDE-ORGANOSOLVENT SPENT LIQUOR ON THE QUALITY OF PULP FROM STRAW

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One of the main reasons for the research and introduction of cooking of non-wood vegetable raw materials using peroxoacids and alcohol into the production is the simple regeneration of components of a cooking solution. Ethyl alcohol from spent liquors is recovered by vacuum distillation. The possibility of almost complete use of components – lignin and carbohydrates – from the spent liquor is attractive in these methods of delignification [1]. It is also known that the composition of spent liquors depends on the cooking conditions and the yield of fibrous intermediate products (FIP) from vegetable raw materials [1].

Therefore, the purpose of the study was to investigate the composition of spent liquor obtained after cooking of wheat straw in the system "acetic acid – hydrogen peroxide – ethyl alcohol", namely after the first stage – impregnation of the straw chop and possibility of its reuse [2-3].

According to the results of complex studies, a straw fiber semi-finished product was obtained with a yield from 75 to 51% and residual lignin content from 5.5 to 1.3% by weight of abs. dry. raw