SYNTHESIS AND PERSPECTIVES OF USING OF ACTIVE CARBON - TiO_2 COMPOSITES

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Growing ecological and economic problems of the present determine the direction of the development of modern material science. Synthesis of effective and economic multifunctional materials appears to be in the focus of the research in recent years.

Due to its relatively low cost, low toxicity and safety for the environment, sufficient chemical and thermal stability and outstanding electronic and optical properties, titanium oxide (IV) may be used as a key element in photoelectronic, lithium-ion and catalytical systems [1]. However, TiO_2 demonstrates several considerable drawbacks, that often prevent it from full-scale industrial use: dependence of efficacy on particle size, low adsorption properties, complication of removal of nanosized TiO_2 powders from the working medium once the process is over etc. [2].

Taking into the consideration modern trends, composite materials that include titanium dioxide attract attention of the researchers because of their outstanding characteristics and promising potential for use for solving numerous practical problems. Herewith, immobilization of TiO_2 particles onto the surface of the porous material allows to overcome drawbacks of single powdered semiconductors. Some porous materials may be used as a support for such composites: silicagel, zeolites, clays and activated carbon [2].

Activated carbon is significantly allocated among others. It has well developed surface area and strong and stable structures. Furthermore, synergetic effect occurs between activated carbon and titanium dioxide, that increases overall efficacy of the photocatalytic process.

In order to achieve immobilization of TiO_2 nanoparticles onto the surface of activated carbon, several techniques may be employed, among which template method, carbon vapor deposition, hydrothermal and sol-gel method may be named. In comparison with other methods, sol-gel technique allows to manipulate structural and morphological characteristics of the TiO_2 nanoparticles, optimize energy use, as well as exploit simple and cost effective technological equipment [3].

Sol-gel immobilization of TiO_2 nanoparticles on the surface of activated carbon allows to obtain composite materials with beforehand planned characteristics. Resulting materials, due to combination of the photocatalytic and adsorption properties may be used in various heterocatalytical processes, such as wastewater treatment, air purification, ecological catalysis, alternative energy sources etc.

References:

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