

# HYBRID PHOTOCATALYSTS BASED ON NANOCCLAYS FOR WATER PURIFICATION



(TECHNOLOGY OFFER P-101)

*The subject of the offer covers hybrid photocatalysts based on nanoclays and their application to photocatalytic reactions, in particular in environment-friendly method of water purification.*

**Water contamination becomes a problem which may limit civilization progress.** The development of a universal and inexpensive method of water purification is very difficult, because it may contain pollutants of different nature, e.g. heavy metals, organic compounds (pesticides, chlorinated aromatic compounds, antibiotics and surfactants) as well as bacteria. The water purification methods currently in use are based on osmosis, ion-exchange, adsorption, ultrafiltration, distillation and photooxidation. Although quite varied, they have limitations, mainly connected with their high power consumption and low efficiency.

**The offered method of water purification is based on the photocatalytic degradation of contaminations.** Photocatalysts are received as a results of the modification of layered nanoclays by polymers that can absorb both visible and ultraviolet light. Experimental tests have shown that hybrid photocatalysts may efficiently degrade water pollutants as a result of oxidation by singlet oxygen, energy or electron transfer. Moreover, it has been proved that hybrid photocatalysts have the ability to adsorb hydrophobic compounds thereby additionally improving the water purification process. Hybrid photocatalysts are especially well-suited for the photodegradation of pesticides, aromatic compounds (e.g. chlorinated aromatic compounds), phenols and cyanides.





## MORE INFORMATION:

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Most of the currently applied photocatalysts are based on low-molecular organic compounds, which are toxic and difficult to be removed from the photoreaction environment. Also, they often cannot be used in an aqueous environment, because of their insolubility. In comparison the key features of the hybrid photocatalysts, that are the subject of the presented offer, are as follows:

- they can be used in an aqueous environment;
- they are based on non-toxic natural minerals (kaolinite, bentonite, mica, talc, which are layered nanoclays);
- at the same time they are capable of purifying water in a physical absorption process as well as in a photodegradation process, therefore they combine the advantages of the photochemical and the adsorption method of water purification;
- they self-separate from water in the sedimentation process, so that they can be easily removed by filtration or decantation;
- their photochemical components may be chromophores of natural origin (e.g. porphyrin derivatives).

Hybrid photocatalysts based on layered nanoclays can become an attractive alternative method of water purification, particularly suitable for industrial plants using water in their technological process, e.g. in power, steel, chemical, pharmaceutical or food-processing plants. Moreover, they can be tailored for specific applications (pollutants).

The application of the hybrid photocatalysts and the method of obtaining them are subject of a patent application. The research and development efforts concerning this technology are continued at the Faculty of Chemistry of the Jagiellonian University. Currently the Centre for Innovations, Technology Transfer and University Development (CITTRU) is looking for companies and institutions interested in obtaining a license for the material and its applications described above.