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APPLICATION OF NANOPARTICLES FOR WASTEWATER TREATMENT

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Nanoparticles are the core materials in the century of developing nanotechnology. Their uniqueness provides indispensable and primary materials in different spheres of human activities. Nano sized metallic particles exhibiting a large surface to volume ratio gained considerable interest in the applications effective catalysts for a variety of chemical transformations as well [1].

At the global level, the treatment of wastewater is one of the key aspects of protecting water resources. It is considered as a dual problem: public and environmental protection issue which is being wide-spread in developed countries as well as developing ones. For the population growth is increasing the contamination of water resources are not satisfying. Therefore it is necessary to purify and recycle the industrial as well as the municipal waste water. For the purpose of purification and recycling of industrial and municipal waste water nanoparticles are significantly important these days for their capability to be highly profitable as absorbents and filters.

<u>Aiming to treat waste water using nanoparticles scientists have discovered many ways for the purification and filtration.</u> In the work called “Antimicrobial three dimensional woven filters containing silver nanoparticle doped nanofibers in a membrane bioreactor for wastewater treatment” have constructed 3D woven fabric filters by wrapping the weft yarn with 2wt% silver nanoparticles (AgNPs)containing electrospun nanofibers [2]. After the disk diffusion test, analyses with the scanning electron and confocal laser scanning microscopy it was found that those woven filters containing AgNPs nanofibers has the lowest bacterial cell, therefore showing lower result of water contamination.

Work was completed on protochemical removal of an anionic antibiotic (ciprofloxacin) by mesostructured high aspect ratio ZnO nanotubes which were mesostructured via diblock copolymer template [3]. Obtained in a such was ZnO showed high catalytic activity, even better (2.9 x faster) result than Degussa P25, a titanium dioxide photocatalyst. In comparison to the method discussed in the previous paragraph ZnO nanotubes have non-woven microstructure which allows them to be easily isolated from fluid reaction media via filtration.There is also the following way suggested for the water remediation: using clay-supported nanoscale zero-valent iron (nZVI) composite materials. In the scope of this work they obtained success in the remediation of contaminated aqueous solutions via utilization of clay supported nZVI composites [4]. Thereupon ,heavy metals, selenite dyes, phenolic, chlorinated organic compounds, nitrate, and polybrominated diphenyl ethers were removed. In spite of the practical value of this work a research is not complete so it needs to be taken into consideration for future work.

Groundwater is also one of our most important sources of water. Unfortunately, groundwater is susceptible to pollutants. Pollutants can be man-made products such as gasoline, oil, road salts and chemicals that get into water and cause life-threatening diseases such as some types of cancer, hepatitis and dysentery. That`s why it is of high importance to separate those water contaminating elements from the water. Magnetic Fe_3O_4 nanoparticle (MNP)-coated fluorinated carbon fabric (CF) membrane has an efficiency in oil-water separation. CF membranes were designed which facilitate separation efficiency as well as ionic removal. Oil drops were quickly removed and the separation rate was utterly high (>95%) [5]. Based on the research`s results we can state that functional CF membrane has a great potential in commerce for various applications such as environmental , public health protection and wastewater treatment.

Another scientists used more facile approach for water purification using ultrathin nanofiltration fibers which have Cellulose nanofiber as an intermediary [6]. The advantage of this method is the membrane`s high permeability, which endows fast water purification and high-efficient separation of small molecules. Ultrafine cellulose nanofiber (UCN) membrane which is modified via interfacial polymerization plays an important role in the waste water treatment. UCN endows an interconnected nanoporous microstructure containing free spaces for the growth of the crosslinked-PEI layer creating narrow permeation channels that are responsible for the transport of water molecules. The resultant membranes comprising an ultrathin selective layer intertwined with cellulose nanofiber matrix are smooth and allow fast permeation of water.

In the work "Combination of nanofiltration and ozonation for the remediation of real municipal wastewater effluents: Acute and chronic toxicity assessment" Acute and chronic toxicity was addressed with *Daphnia magna*, *Vibrio fischeri* and *Selenastrum capricornutum. During the experiment* Microcontaminants were eliminated (>99%) by ozonization but acute toxicity increased. Accordingly acute toxicity was related to microcontaminant byproducts or other water components. Researchers came to a conclusion that before the implementation of ozonization the transformation products must first be examined and the treatment time or ozone doses should be extended to complete degradation if necessary.

Any form of water that has been contaminated by a commercial or domestic process, including sewage and byproducts of manufacturing and mining – is largely an issue in any nation. From the discussed materials above each method has advantages in its own way, but preferably is the way which is fast and sustainable. Water can be contaminated by numerous factors, and purification of it can`t wait. ZnO nanofibers , in my opinion, are the most practical, less time consuming, and financially beneficial method to use nowadays, even though each of the methods having been considered can find its implementation in the sewage, groundwater , and municipal water treatment.

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