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Nanocomposite for soils remediation based on iron nanoparticles with biopolymer on bentonite

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Zero-valent iron nanoparticles and nanocomposites based on them are being increasingly used in the purification of various media such as sewage water and soils from persistent organic pollutants (POPs). The main cause for the limited use of these materials is the toxicity of iron nanoparticles with respect to soil microorganisms. The design of a material (composite) exhibiting reactivity in pesticide degradation and simultaneously having a positive influence on the soil microflora is a problem of current concern. We propose a nanocomposite based on bentonite of grade (ERBSLÖH, PORE-Technology) exposed to a biopolymer and iron nanoparticles precipitated during the reduction of simple iron salts. The resulting nanoparticles were characterized by X-ray powder diffraction (XRD) analysis, scanning electron microscopy (SEM), and FTIR spectroscopy. XRD analysis of the iron nanoparticles and nanocomposite powder was conducted on a Panalytical Empyrean X-ray diffractometer (–2 , CuK 1+ 2 radiation, =1.54184 Å). The XRD pattern of Fe nanoparticles with the diffraction peak at 2θ=44.8° was recorded. The avarage particle size, which was calculated by the Debye–Scherrer formula was 4 nm. The observed diffraction peaks at 2 =35.81 , 41.2 4 , 44.81 , 46.05 , 54.80 and 63.04° were attributed to both bentonite and iron nanoparticles. The ecotoxicity of the nanocomposite was studied on microorganisms *Alternaria sp*., 4D and P.viride. The results confirm that Fe(0) nanoparticles can act as both stimulators and inhibitors of growth of micellar fungi. The stimulating effect of Fe(0) nanoparticles was observed in three of the five strains of micromycetes namely 1LD, 5D and 8D. The growth of strains *Alternaria sp*., 4D and P.viride was significantly maintained in the presence of the nanocomposite (AI of 26.88% and 13.91% respectively). At the same time Fe(0) nanoparticles in common with magnetite Fe3O4 nanoparticles have a stimulating effect on the formation and maturation of spores in micromycetes. Thus, the proposed nanocomposite provides a decrease in the toxic effect on the soil micro society while maintaining the ability to degrade some POPs, such as DDT, DDD, and DDE.

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