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Constructive Design of Bioremediation Strategy based on Bio-composites

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1. Introduction – Kazakhstan as a rapidly developing country is facing unprecedented environmental and economic challenges. Discharge of contaminant-rich wastes from agricultural, domestic and industrial sources has led to adverse effects on terrestrial and aqueous ecosystems. Discovery, improvement and application of various microbes and their products to transform, remove and inactivate pollutants promotes the efficiency of the environment protection. Bioremediation uses different active species of microorganisms alone or in combination with sorbent/carrier, which can greatly maintain the viability, proliferation and implementation of the biological objects. Compared to "conventional" sorbents, the bio-composite sorbents are cheaper, eco-friendly and reusable alternative for the remediation of various pollutants, especially hydrocarbons, heavy metals and pesticides from wastewater. This is now under intensive investigations focusing on effective pollutant removal, different biosorption mechanisms and modeling, modification and immobilization of biocatalysts, the construction of novel bio-composites, their assessment, potential application and relevance for any particular purpose (Image 1) [1].

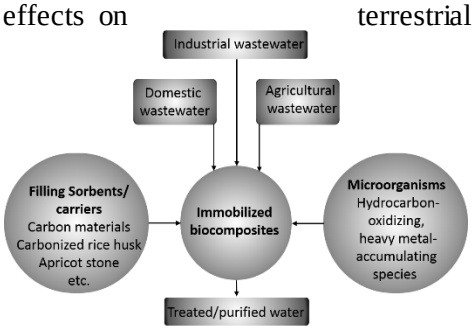

Image 1. Model of the bio-composite construction design

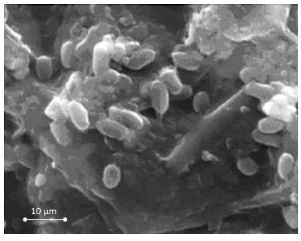

Image 2. Electron microphotograph of the heterogeneous bio-composite

2. Experimental - Due to their potential properties, nanostructured carbon materials, including carbonized rice husk and grape stones can be used as sorbent/carrier for separation and extraction of toxic compounds and elements. The new cost-effective and environmantal sustainable bio-composite based on microbial cells immobilized on carbonized materials has been successively designed and developed. Electron microscopy images showed that active microbial cells can attach, proliferate and migrate inside the porous network of the sorbent (Image 2). Our extensive experiments