Humic substances in municipal water management

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Humic substances (HSs) are products of organic matter decomposition process, mostly of plant and animal origin. HSs are present in soil and in aquatic environment (surface and groundwater). Research conducted for over a dozen years, including these at the Cracow University of Technology, shows that municipal management is an important source of HSs formation. They were found in the water intake for municipal drinking water purposes, but also in leachate of municipal landfills, activated sludge, leachate of excess and digested sludge, as well as raw, treated and treated wastewater. Leachate from municipal landfills, due to the high concentration of organic and inorganic pollutants, is discharged to a biological treatment plant. Since the HSs contained in them are not biodegradable, they are partially adsorbed on the activated sludge, while the light fractions remain in the treated wastewater and are discharged mostly to rivers, from which water is intake for municipal purposes. In water treatment plants, HSs generate carcinogenic, mutagenic and teratogenic compounds during the oxidation process. At the same time, HSs are essential for plants, contribute to soil fertility, transport organic and inorganic substances to the root mass, and maintain an optimal level of soil moisture. Statistical data show that in Poland there is almost 65,000 hectares of land requiring reclamation. For example, according to the Central Statistical Office, the greatest number of such land is in the Greater Poland (10.9 thousand ha) and Lower Silesia (8.1 thousand ha) voivodeships, as well as in Silesia, Warmia-Masuria and Lodzkie (approximately 4.9 thousand ha each). Therefore, the work includes isolation of humic substances from many sources of the municipal management. Qualitative analysis confirmed the presence of HSs in the given sources - they were mainly fulvic acids due to their high mobility. For this purpose, the extracts were analyzed for the UV-VIS and IR spectrum as well as the qualitative analysis of the elemental composition and inorganic micropollutants. The obtained test results confirmed that the main organic substances are HSs, occurring depending on the source in various concentrations. Phytotoxicity tests were carried out for selected humic substances, which showed their high suitability for plant cultivation. The analysis of the number of biological wastewater treatment plants and the amount of sewage sludge produced in Poland and municipal waste landfills generating leachate with a high concentration of HSs indicates that municipal management is an attractive source of humic substances that can be used for the revitalization of wastelands and reclamation of degraded areas.