Semi-technical scale research on constructed wetland removal of aliphatic hydrocarbons C7–C40 from wastewater from a car service station

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ABSTRACT

Dynamic development of road infrastructure and a significant increase in the number of cars are important challenges making it necessary to rationally treat and manage stormwater polluted with oil derivatives. Ecological engineering can be a source of valuable solutions in this domain, which are in agreement with sustainability principles, friendly to environment and hydrological cycle, convenient and attractive to the users. The article presents the results of research on using constructed wetlands to remove oil derivatives, which have been conducted with the semi-technical scale experimental installation planted with Phragmites australis, treating stormwater from a car service station in Sosnowiec. The results and discussion focus on the concentration of individual aliphatic hydrocarbons, their sum, as well as the efficiency of their removal by the studied installation. Some additional parameters of analysed wastewater such as temperature, suspended solids, pH, conductivity and air temperature have been also presented and discussed. The condition of the reed population has been also evaluated and discussed. The concentration of total aliphatic hydrocarbons (C7–C40) in raw wastewater was on average 2,311.67 μg/L (121.08–17,664.02 μg/L) and much lower in treated wastewater—261.81 μg/L (77.09–532.56 μg/L).

All measured hydrocarbons concentrations in wastewater flowing out of the experimental installation were much lower than the standard value, defined by Polish law for wastewater released to the environment or to the sewage system. Some relatively high values of the aliphatic hydrocarbons removal rate were also observed (averagely 67% for C7–C40 and 64% for C7–C30). The analysis of research results in relation to individual aliphatic hydrocarbons showed that most efficiently removed ones were hydrocarbon C20–C33 (on average around 80%), C34–C40 and C12–C19 with slightly lower efficiency (60–70%), and least efficiently—lightest hydrocarbons C7–C11. Common reed P. australis confirmed its high applicability in constructed wetlands which treat stormwater polluted with oil derivatives. Generally, the experiments confirm high potential of constructed wetlands to remove oil derivatives from wastewater.

Keywords: Constructed wetlands; Stormwater management; Oil derivatives; Aliphatic hydrocarbons

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