Analysis of organic and inorganic compounds in rainwater from the highway and its treatment in membrane processes

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ABSTRACT

Municipal stormwater is a common source of organic and inorganic pollutants. Rainwater pollution from the streets can be affected by traffic, that is, wear and tear of tyres, brake linings, engines and vehicle bodies. The main objective of the research was to determine the type of pollutants present in rainwater from the highway, and then the possibility of their removal in membrane processes. A number of analyses were performed to determine the concentration of organic and inorganic pollutants and toxicity tests and microbiological studies were performed. Rainwater contained heavy metals in the amount as follows: nickel 0.41 mg/dm$^3$, zinc 5 mg/dm$^3$, lead 0.52 mg/dm$^3$. In rainwater, both typically industrial compounds (biphenyls, polycyclic saturated hydrocarbons, aromatic hydrocarbons, phenols and bisphenol A), naturally occurring compounds and components of plant protection products were determined. Rainwater toxicity was expressed as percentage inhibition of *Vibrio fischeri* luminescence after 5 and 15 min of incubation and based on the growth of the freshwater vascular plant *Lemna minor*. Water showed toxicity to *V. fischeri* at 27.52% (5 min) vs. *L. minor* at 33%. In the ultrafiltration process, the retention coefficient of organic compounds, that is, TOC and phenol, was respectively 9% and 79%, while in the case of heavy metals, the following values were obtained: Ni(II) 75%, Pb(II) 67%, Zn(II) 98%, and octadecane was reduced by more than 81%. In the nanofiltration process, the retention coefficient was higher and was at the TOC level 100%, phenol 90%, Ni(II) 82%, Pb(II) 67%, Zn(II) 98%, and the octadecane was reduced by more than 85%.

Keywords: Rainwater; Ultrafiltration; Nanofiltration; Micropollutants

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