Abstract

The objective of this study was to evaluate the effectiveness of unit water treatment processes in removing organic substances with specific properties, particularly their level of aromaticity. The research was conducted under technical conditions at three surface water treatment plants, focusing on raw water samples and water samples taken after each unit process. The examined water sources exhibited varying levels of total organic carbon concentration and different distributions of molecular weight.

The study assessed the efficiency of organic substance removal in conventional water treatment system and examined the relationships between parameter values and changes in water quality parameters used to evaluate organic matter content (TOC) and molecular weight distribution. The findings relationsheep from the reference system were validated in two other water treatment systems. This approach enabled the identification of relationships between water quality parameter values across unit processes, regardless of the type of surface water source.

Guidelines were developed for evaluating unit process performance based on spectrophotometric measurements, specifically their changes, which can be used to improve process control in daily technological monitoring. Simultaneously, the obtained relationships facilitate the assessment of the properties of organic substances removed during water treatment processes based on spectrophotometric measurements.

The results demonstrated that coagulation and adsorption processes provide the highest removal efficiency for humic substances, which dominate in surface waters. Additionally, dual-stage coagulation enables further elimination of fulvic substances. Oxidation processes, both intermediate and final, resulted in the transformation of high-molecular-weight substances into smaller ones, including amino compounds. The degree of organic matter mineralization was directly proportional to changes in UV_{254} absorbance.

Changes in the content of organic substances with molecular weights greater than 2 kDa were indicated by variations in absorbance at 254 nm, while particles in the range of 1.3–1.5 kDa were reflected in absorbance at 272 nm.

Keywords: humic substances, fulvic substances, amino substances, water treatment, surface water, molecular weight distribution.