Impact of selected activators and inhibitors on efficiency in removing haloacetic acids from water in a reactor with native and immobilised biocatalysts

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ABSTRACT

The objective of the described tests was to determine the impact of selected activators and inhibitors on the efficiency of removing mixtures of haloacetic acids (HAAs) from water. The tests were conducted in the bioreactor equipped with an ultrafiltration polyacrylonitrile membrane with native and immobilised enzymes. The scope of tests included three series of measurements for reference waters, where each acid (monochloroacetic acid—MCAA, dichloroacetic acid—DCAA, trichloroacetic acid—TCAA, monobromoacetic acid—MBAA, and dibromoacetic acid—DBAA) was mixed with another acid. The mixtures with HAA concentrations within the range from 0.01 to 0.005 mmol/dm³ varied in their qualitative and quantitative composition. The obtained test results led to the conclusions that three of five tested acids were competitive inhibitors—MCAA and MBAA for DCAA, TCAA and DBAA, and DCAA for TCAA and DBAA. Such a regularity was observed for both native and immobilised enzymes. The catalytic activity of native enzymes was higher by ca. 38%, compared to immobilised enzymes. However, immobilised biocatalysts were far less prone to the impact of inhibitors. It was noticed that Cl⁻, SO₄²⁻, Mg²⁺, Zn²⁺, Ca²⁺, and Fe³⁺ ions had no effect on the activity of applied enzymes, both in the case of native and immobilised enzymes. Only a slight increase (by ca. 3–4%) in the catalytic activity of enzymes was observed in both cases in the presence of Mn²⁺.

Keywords: Haloacetic acids; Native and immobilised enzymes; Biodegradation; Enzymatic activity

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