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Assessment of the activated sludge toxicity in technologies of biological and physico-chemical wastewater treatment

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Abstract

The toxicity and phytotoxicity of activated sludge formed in the process of combined biological and physico-chemical wastewater treatment with traditional ($FeCl_3$, $Al_2(SO_4)_3$) and innovative (Biokat P 500, Nanofloc) chemical precipitators were investigated. *Paramecium caudatum*, *Daphnia magna Straus*, *Triticum durum*, *Pisum sativum*. were used as test organisms to determine toxicity. Samples of activated sludge were obtained as a result of periodic and fill and draw cultivation of active sludge with chemical precipitators and model solution of wastewater. After the expiration of the 24-hour process of biological wastewater treatment with a single injection of reagents the significant inhibition of the test - hydrobionts was not observed, the samples with $FeCl_3$ and $Al_2(SO_4)_3$ were the most toxic, which caused the inhibition of 17% and 14% of infusorium, respectively. At the same time, data on germination, growth energy, morphological and biometric parameters of plants cultivated in the medium of the obtained samples showed that samples of activated sludge without chemical precipitators stimulated the growth of test organisms. Samples with Biokat P 500 and Nanofloc reduced the stimulating effect of sludge, samples with $FeCl_3$ and $Al_2(SO_4)_3$ resulted in the appearance of phytotoxicity. Repeated introduction of coagulating preparations under conditions of fill and draw cultivation of activated sludge contributed to increase the toxicity of samples for *Paramecium caudatum*, the maximum toxicity value – 24% and 20% were observed in samples with $FeCl_3$ and $Al_2(SO_4)_3$, respectively. The degree of toxicity for samples with Biokat P 500 and Nanofloc is 10%.

Data from the study of the activated sludge samples toxicity on *Triticum durum* after 4 days of cultivation with multiple dosing of chemical precipitators indicate an increase in the degree of phytotoxicity of samples with reagents. The lowest values of wheat growth inhibition are typical for samples with Biokat P 500, for activated sludge with Nanofloc these values were higher, but did not exceed 10%. Samples with $FeCl_3$ led to decreasing in the morphometric and biometric parameters of wheat roots (toxicity was 11-22%), activated sludge with $Al_2(SO_4)_3$ led to decline in the growth of wheat roots by 19-22% and seedlings by 13-14%.

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