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Testing the Biodegradation of Diclofenac: Towards a Sustainable Environment

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The presence of pharmaceuticals in wastewater is becoming an increasingly serious threat to the aquatic environment and public health. Pharmaceuticals are typically, used in small therapeutic doses, but often enter wastewater systems. Mainly through excretion from the body, but also as a result of inadequate disposal of outdated medicines. The increased availability of medicines and the public's tendency to misuse them exacerbate the problem. In addition, many pharmaceuticals are not completely removed by conventional wastewater treatment systems, leading to their accumulation in the aquatic environment with a range of consequences for the receiving ecosystem. One particular medicine, is diclofenac (DFC) - an anti-inflammatory drug. Due to its toxic effects on aquatic organisms, its presence in the environment needs be monitored and its discharge into surface waters needs be restricted. The introduction of DFC into the environment can lead to many other negative effects. Its presence in wastewater and water is therefore a serious challenge for modern environmental engineering, requiring the development of effective methods and technologies to prevent its introduction into the environment.

In the present study, an attempt was made to biodegrade diclofenac using SBR-type bioreactors – working in the cycles consisting of the filling aeration, settling and drawing phases. Firstly, the adsorption of DFC on activated sludge was tested – after the inactivation by sodium azide. After 60 minutes of the experiment, a 20% reduction in DFC content on the activated sludge was recorded. DFC biodegradation studies were conducted for 3 different concentrations: 4, 10 and 20 mg DFC/L. During the experiment, no effective removal of diclofenac from the introduced model wastewater stream was observed. On the contrary, a gradual accumulation of the selected drug was observed in the bioreactor, which may indicate its stability under the conditions of the applied process and its overall limited biodegradability.

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