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Nsaids Biodegradation in Activated Sludge by Drug-Consuming Bacterial Strains in SBR System

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Extended Abstract

More than half a century ago, the first case of the presence of drugs in the natural environment was identified [1]. Since then, the frequency of detection of this type of contamination has been increasing yearly, both through increasing consumption and analytical ability. Due to the influence on the physiological state of organisms and high stability, even in low concentrations, drugs pose a real threat to biological systems - both for individual organisms and entire populations [2]. Today, many pharmaceuticals are resistant to elimination in conventional wastewater treatment plants [3]. Hence, the search for effectively eliminating this type of contamination from water systems is essential.

In our research, we attempted to introduce bacterial strains (Bacillus thuringiensis B1 (2015b) and Pseudomonas moorei KB4) with an increased ability to degrade NSAIDs (nonsteroidal anti-inflammatory drugs) into the activated sludge system and to determine the effectiveness of the elimination of selected drugs- diclofenac, naproxen, ibuprofen and paracetamol and in concentrations of 1, 1, 5 and 10 mg per litre, respectively.

The process was carried out in an SBR bioreactor for 28 days at 18 Celsius degrees, with 7-day bioreactor cycles. The used co-pollutants were methanol (1%), phenol (1mM), copper (II) (0.1mM). As an additional carbon source, we used whole cow milk.

Preliminary studies show that bioaugmentation with selected bacterial strains increases the effectiveness of drug elimination while not affecting the condition of the activated sludge (nitrogen assimilation, parameters of CZT, BOD5). During 7-days cycles, the SBR system showed growing potential in NSAIDs degradation per cycle. Every next cycle shows a better elimination time of the new drug dose.

At the same time, the used strains show good survival in the system, being introduced in the form of a concentrated suspension. The best strain ratio was stable for at least two weeks of the trial. After that, slightly fluctuation was observed. Further, plans include attempts to prepare the strains in the form of a permanent microbial vaccine.

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