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DEGRADATION OF SULFAMETHOXAZOLE BY PURE STRAINS ISOLATED FROM AN ACCLIMATED MEMBRANE BIOREACTOR

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Abstract

Sulfonamide antibiotics such as sulfamethoxazole are readily found in surface waters worldwide in concentrations of up to several micrograms per liter. Due to the risk of spreading antibiotic resistances, their ubiquitous presence is of great concern. Especially sulfamethoxazole has been shown to be difficult to remove in biological wastewater treatment plants, and results can be highly variable. Currently, only energy-intensive processes such as ozonation and methods based on it are able to completely transform sulfamethoxazole. Nevertheless, possible by-products of incomplete treatments have not yet been tested for negative impacts on the environment. Until now, only two studies reported the removal of sulfamethoxazole from the aqueous phase by pure strains. However, the apparent biodegradation remained below 30% in both cases. This evidences the need to isolate and identify bacterial strains able to biodegrade sulfamethoxazole to higher extent.

A total number of five strains able to grow on sulfamethoxazole as a carbon and energy source were isolated from a membrane bioreactor continuously fed with synthetic wastewater spiked with sulfamethoxazole. Single isolates and a consortium were tested for degradation of ^{14}C-sulfamethoxazole. Mineralization was detected by trapping the formed $^{14}CO_2$ in NaOH. Within few days, significant amounts of the total applied radioactivity could be recovered in the CO_2 traps, indicating a fast mineralization. A mixed consortium revealed even higher rates of mineralization than those observed in the resepective axenic cultures. Analysis of the culture media after incubation revealed the presence of a peak in one axenic culture which was not present in other ones nor in the mixed culture. Currently we are investigating the nature of the metabolite.

A better understanding of sulfamethoxazole degradation by bacteria may contribute to the optimization of biological wastewater treatment plants for the efficient removal of pharmaceuticals.