

BIODEGRADATION OF WATER EMERGING PHARMACEUTICAL CONTAMINANTS BY TWO MICROBIAL CONSORTIA FROM DIFFERENT ORIGINS



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INTRODUCTION

The advances in organic synthesis and the intensive use of pharmaceuticals have led to the introduction of numerous of these compounds in the environment, whose susceptibilities to biotreatment processes are unknown. Pharmaceuticals can reach the environment through excretion in the original chemical structure or as metabolites and through improper elimination or disposal (Corcoran et al., 2010). Their occurrence, especially in aquatic environments, is of great concern because of their potential to cause ecosystem alteration (Santos et al., 2010). Currently, the conventional wastewater treatment plants (WWTPs) are not designed and operated to remove pharmaceuticals. As a result, residues of these compounds have been detected in aquatic ecosystems in low concentrations ranging from the ng/L up to the µg/L level (Kümmerer, 2009). In this context, the present work aimed to investigate the potential of two different microbial consortia to biodegrade five pharmaceuticals, belonging to three different therapeutic classes, commonly used and present in wastewaters: the antibiotics - trimethoprim (TMP), sulfamethoxazole (SMX) and ciprofloxacin (CPF), the anti-epileptic - carbamazepine (CBZ) and the anti-inflammatory - diclofenac (DCF) (Fig. 1).

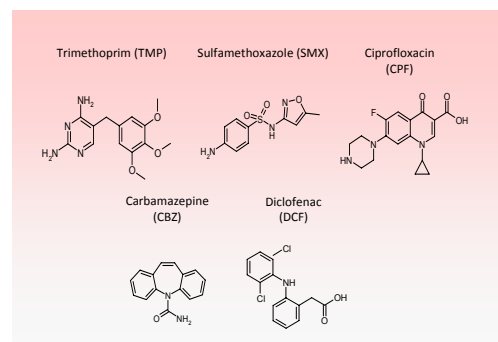


Figure 1. Chemical structure of the studied pharmaceuticals.

EXPERIMENTAL APPROACH

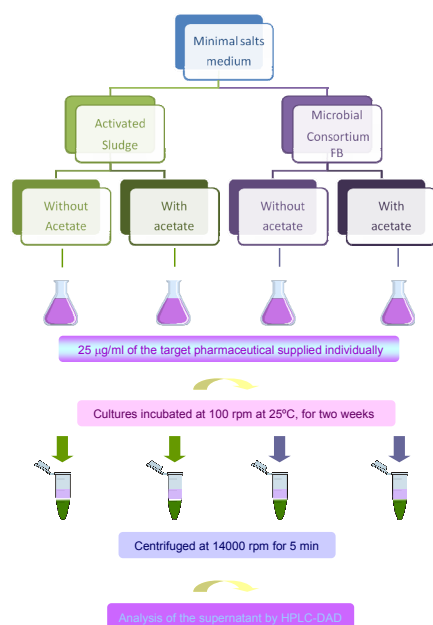


Figure 2. Schematic representation of biodegradation assays.

RESULTS AND DISCUSSION

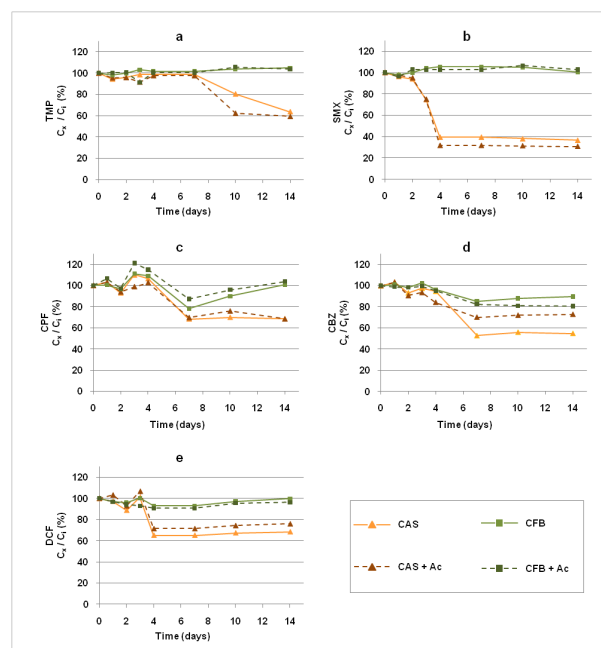


Figure 3. Biodegradation pattern of the target pharmaceuticals by activated sludge (CAS) and the FB degrading consortium (CFB).

✓ Biodegradation assays conducted with two different microbial consortia: activated sludge obtained from a WWTP (Parada, Portugal) and one microbial consortium capable to degrade recalcitrant compounds, such as fluorobenzene (FB).

✓ Experiments conducted in duplicate and in batch mode.

✓ Abiotic degradation assays performed by supplementing MM with a mixture containing 10 µg/mL of each pharmaceutical, without inoculation of any consortium.

✓ None of the tested consortia was able to completely degrade the target pharmaceuticals.

✓ Activated sludge showed a significant capacity to degrade SMX and some capacity to degrade the others pharmaceuticals tested, with removal efficiency values always higher than 30%.

✓ The FB degrading consortium was only able to slightly remove CPF and CBZ.

✓ Acetate showed to not have a strong influence in the pharmaceuticals biodegradation pattern by both consortia.

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