

Bioremediation strategies for water polluted with pharmaceuticals

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1. INTRODUCTION & AIM

The occurrence of pharmaceuticals in aquatic environments has become a global concern due to their continuous release from wastewater treatment plants and their potential adverse effects on ecosystems and human health.

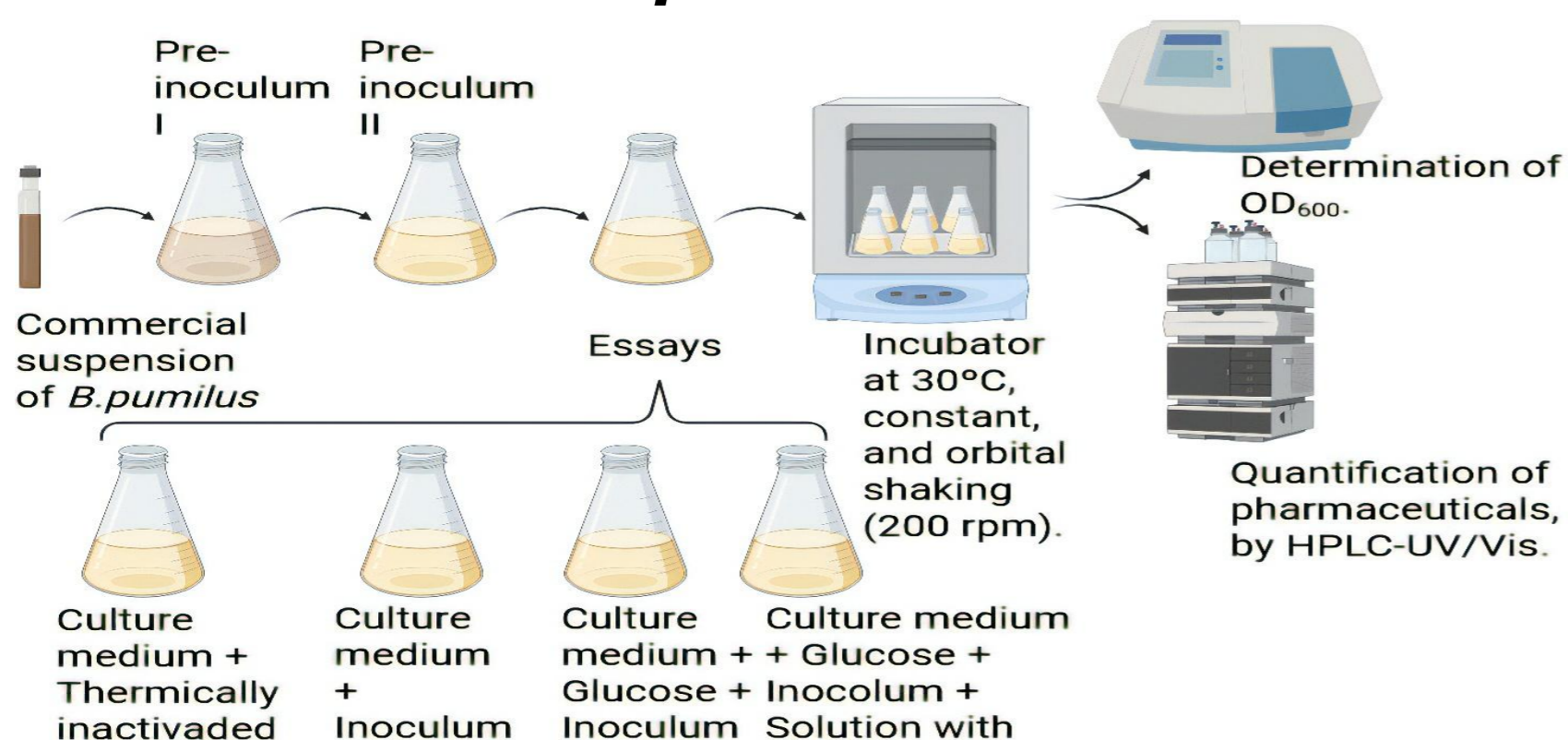
Bioremediation has emerged as a promising alternative owing to its environmental compatibility and cost-effectiveness.

Bacillus species are of particular interest due to their environmental resilience, metabolic versatility and ability to remove emerging contaminants such as pharmaceuticals.

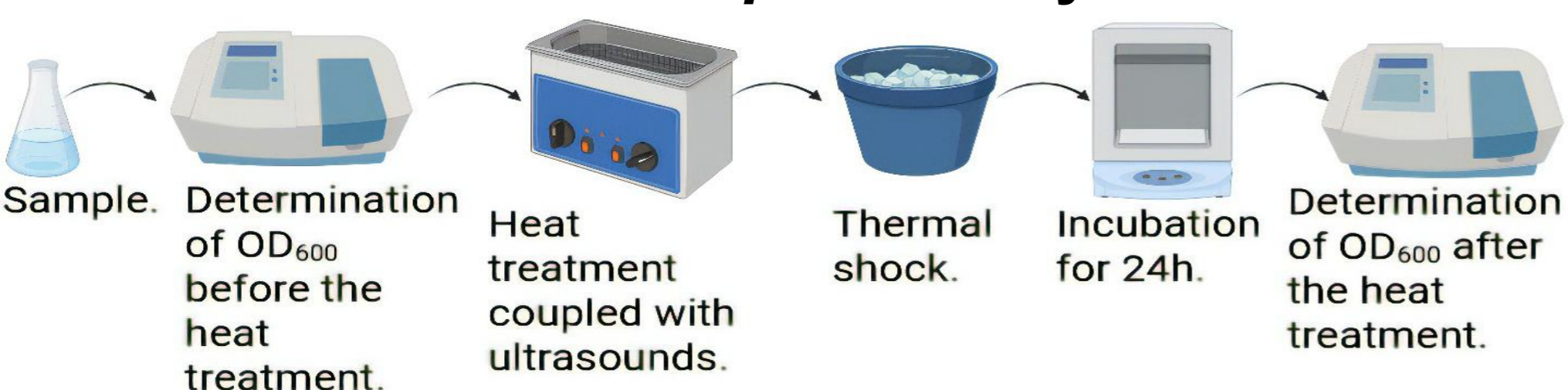
This study aimed to evaluate the ability of *Bacillus pumilus* to remove four commonly detected pharmaceuticals — ibuprofen (IBU), diclofenac (DCF), naproxen (NAP) and carbamazepine (CBZ) — from contaminated water.

2. METHODS

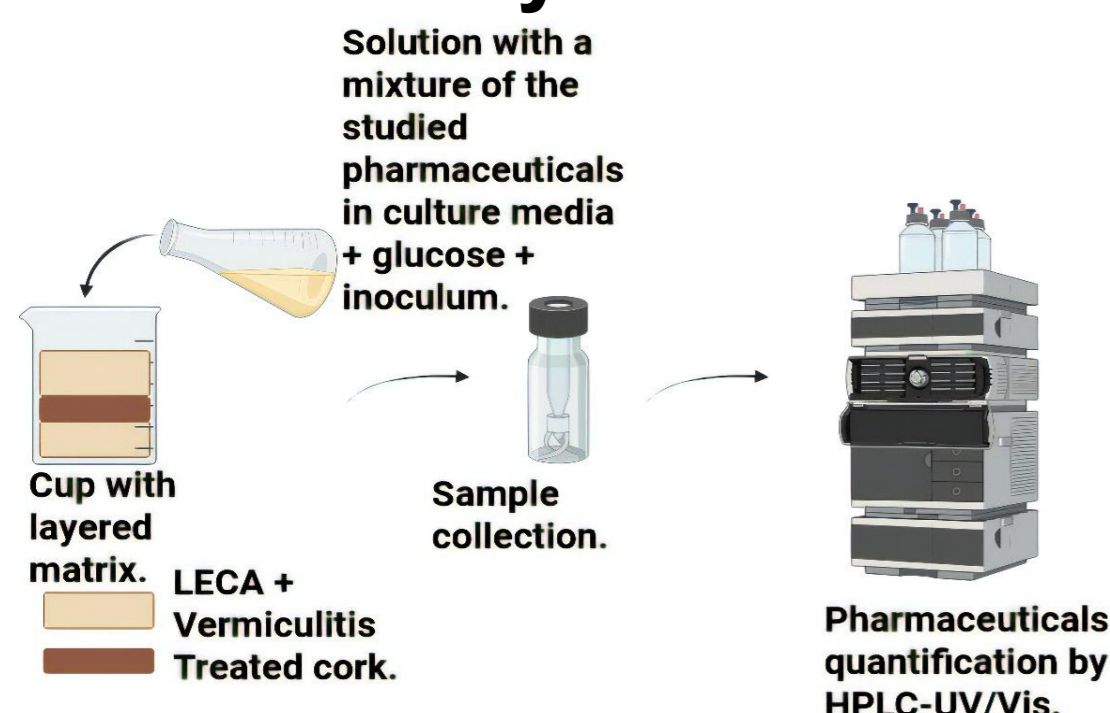
2.1 Growth of *B. pumilus* culture



2.2 Inactivation of *B. pumilus* by heat



2.3 Pharmaceuticals removal with *B. pumilus* inoculated in a layered matrix

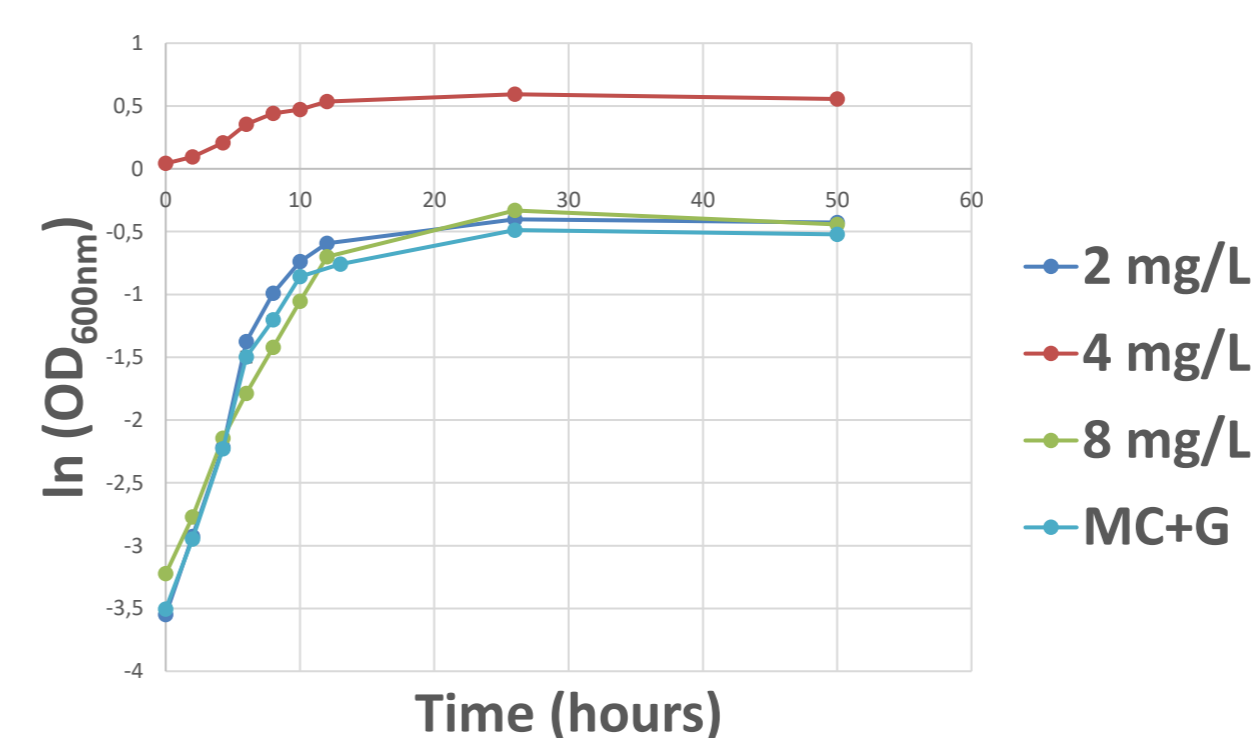
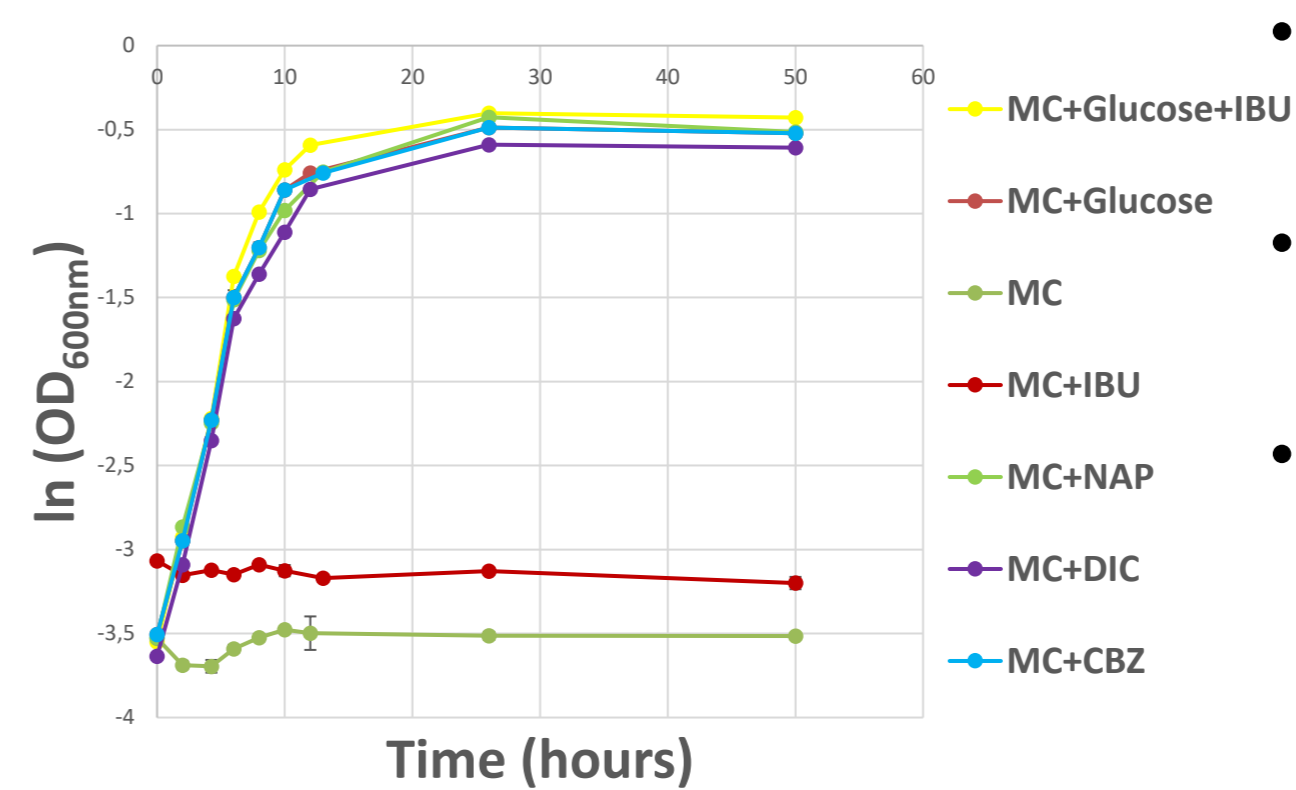


4. CONCLUSION

- Culture media composition influenced *B. pumilus* growth.
- Pharmaceutical removal occurred mainly during the lag phase, suggesting an important role played by adsorption.
- These preliminary results suggest that *B. pumilus* has potential for application in pharmaceutical removal.

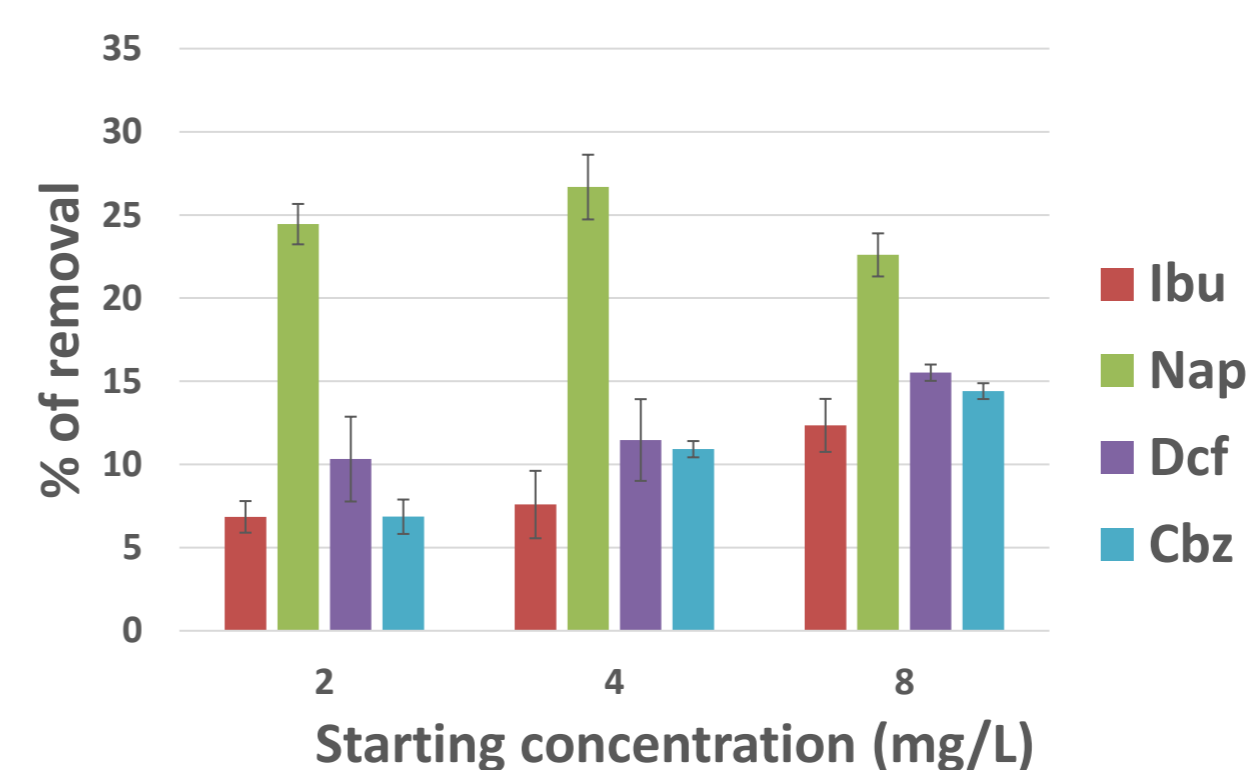
3. RESULTS & DISCUSSION

3.1 Bacterial growth and the effects of pharmaceuticals exposure



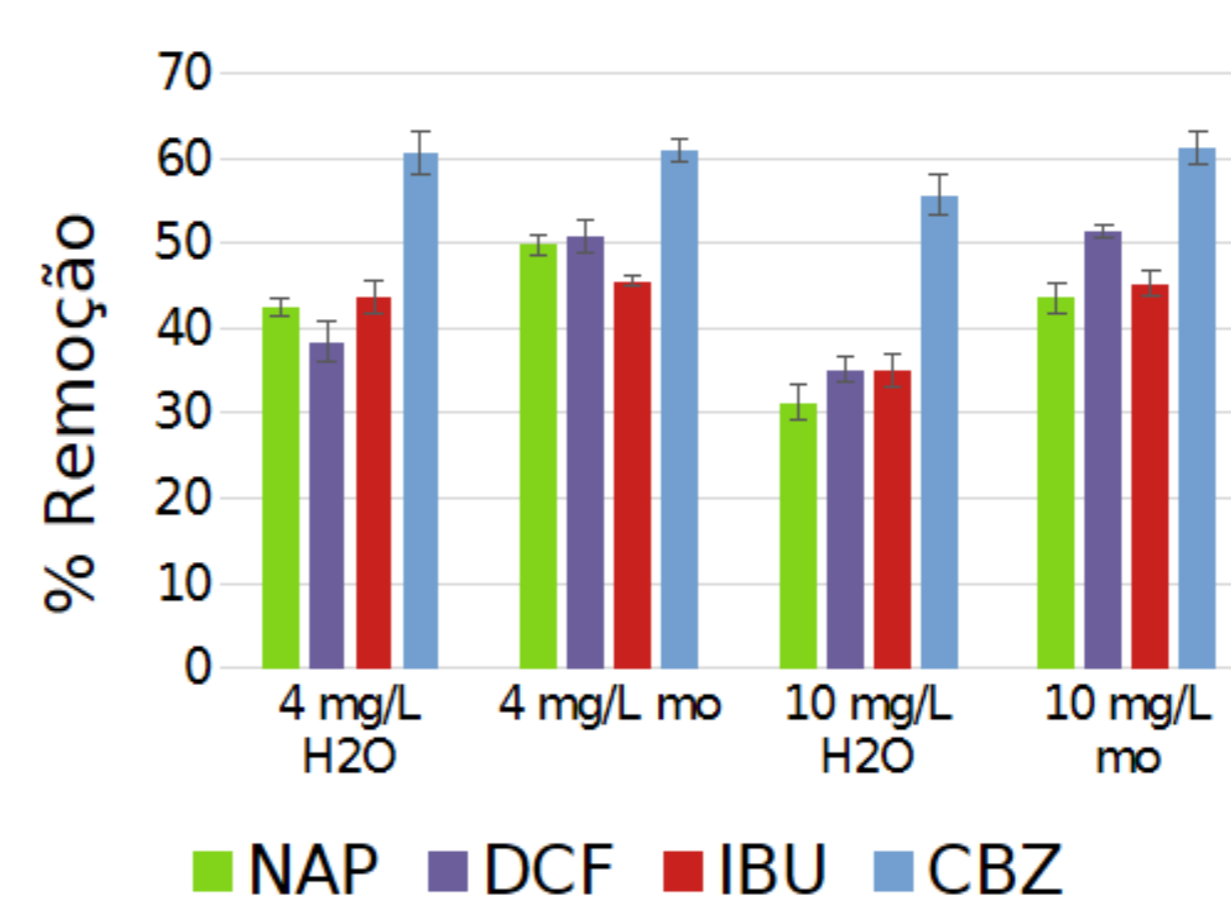
- Glucose was essential for bacterial growth.
- At 2 mg/L, no inhibitory effect was observed.
- *B. pumilus* grew in the presence of all pharmaceuticals.
- Higher concentrations of IBU reduced the growth rate.
- Similar results were obtained for the other pharmaceuticals.

3.2 Pharmaceuticals removal



- Removal occurred under all tested conditions.
- Removal efficiencies after 50 h reached up to 11.5% for ibuprofen, 15.5% for diclofenac, 26.7% for naproxen and 14.4% for carbamazepine.

3.3 Contribution of the bacteria for the removal of pharmaceuticals in a layered matrix



- The presence of *B. pumilus* increased the removal efficiencies for all pharmaceuticals in the matrix.
- In the layered matrix, carbamazepine showed the highest removal.

5. FUTURE WORK

Future work will focus on distinguishing adsorption from biodegradation, identifying transformation products, evaluating the performance of the bacterium in complete constructed wetland microcosms and optimizing operational conditions to maximize pharmaceutical removal.