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Microbial Degradation Potential of Emerging Contaminants by Isolated Bacterial Strains

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Background

- High concentration of CECs in Capbreton Canyon^[1]
- Isolation of 37 strains from sediments enriched with CECs^[2]
- Selection of strains capable of degrading CECs^[2]

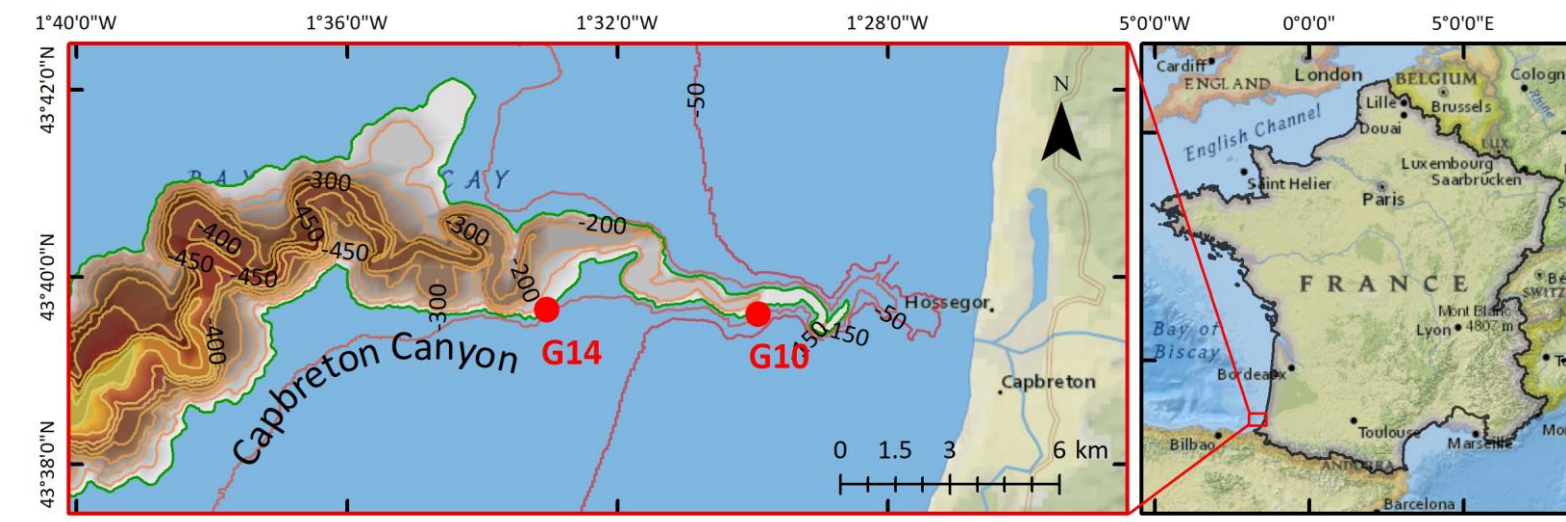


Fig 1. The location of sediment sampling sites used isolation of pure bacterial strains, Capbreton Submarine Canyon^{[2], [3]}.

Scientific Questions

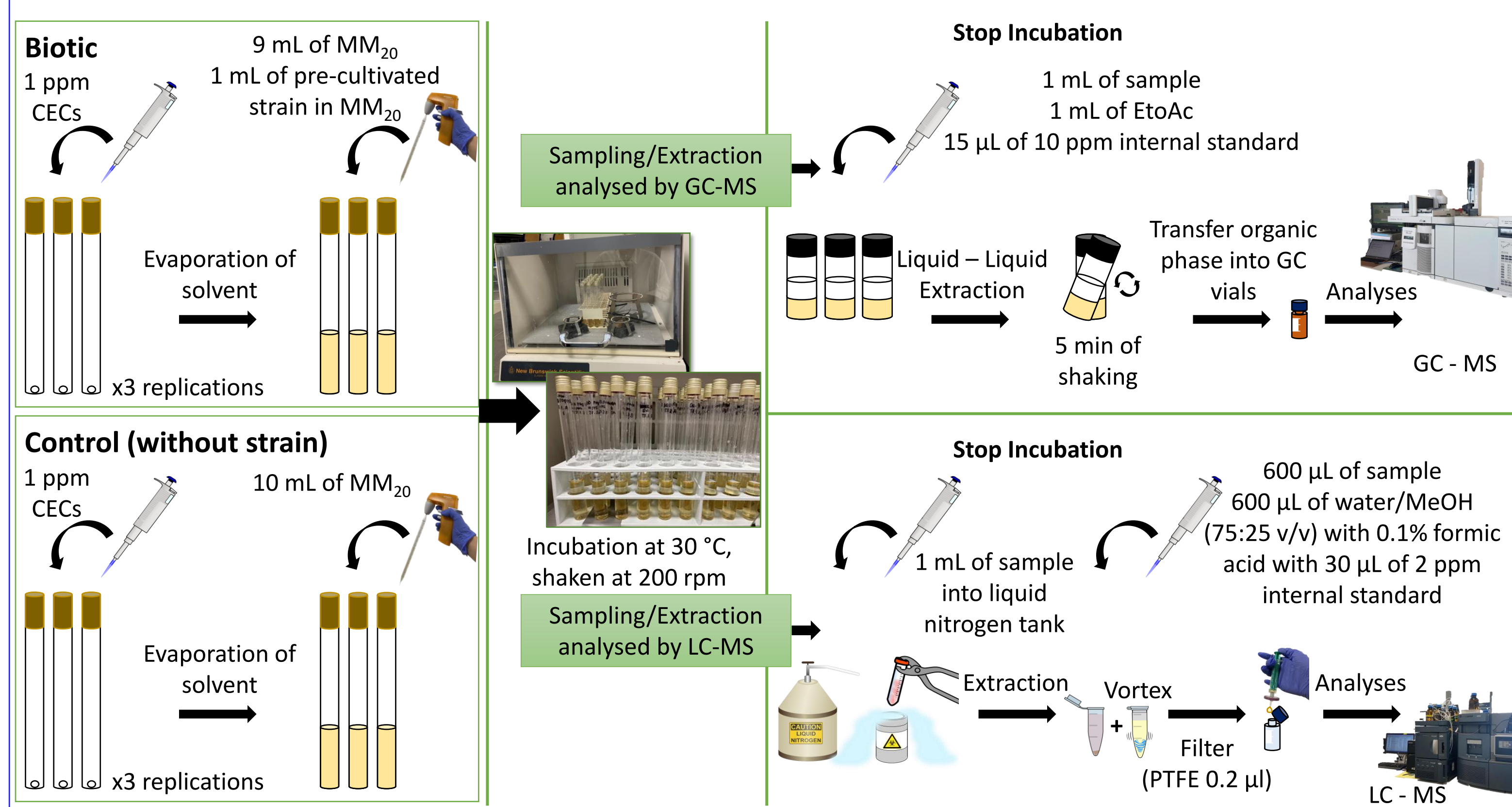
- What is the ability of pure strains isolated from marine sediments to degrade various contaminants of emerging concern (CECs) that have been frequently used in perfumes, personal care products, pharmaceutical industries, and agricultural activities?
- Is there any relationship between their biodegradation potential and resistance?

Material and Methods

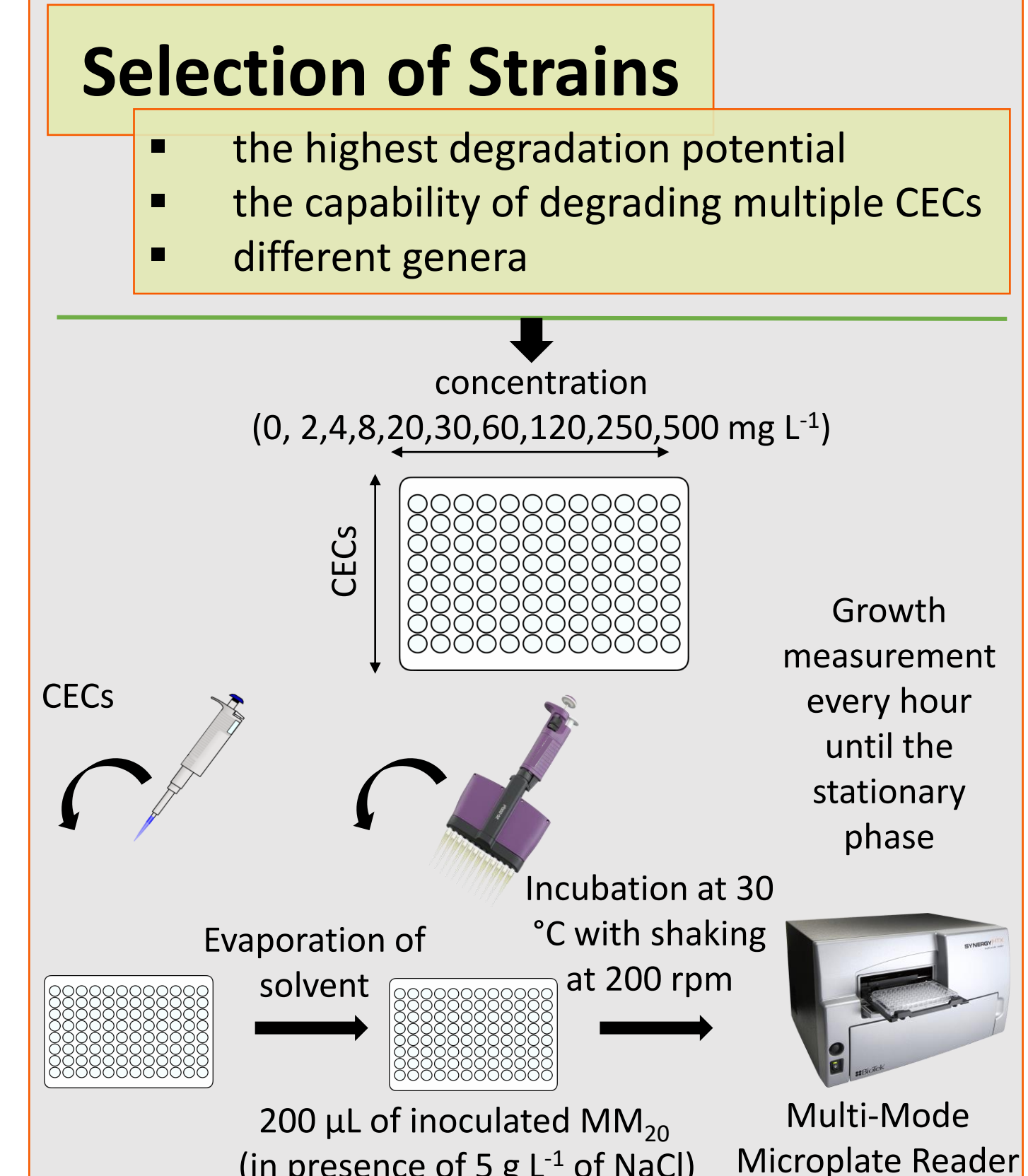
Used CECs and Strains

Hydrophobic Compounds			
Musks	Galaxolide (HHCB)		
	Tonalide (AHTN)		
UV-Filters	Octocrylene (OC)		
	Padimate-O (OD-PABA)		
Hydrophilic Compounds			
Pesticide	Atrazine		
Pharmaceuticals	Ketoprofen		
	Oxazepam		
Isolated Strains from Marine Sediments			
Code	Strain	Genus	
S-1	2 HHCB (O) G10	<i>Bacillus</i>	
S-2	2 HHCB (J) G10	<i>Bacillus</i>	
S-3	23 AHTN G14	<i>Bacillus</i>	
S-4	23 AHTN G14 (R)	<i>Rhodococcus</i>	
S-5	35 OD PABA G14	<i>Bacillus</i>	
S-6	40 OC G14	<i>Bacillus</i>	

Biodegradation Experiments



Toxicity Test



Results

Microbial Degradation of CECs

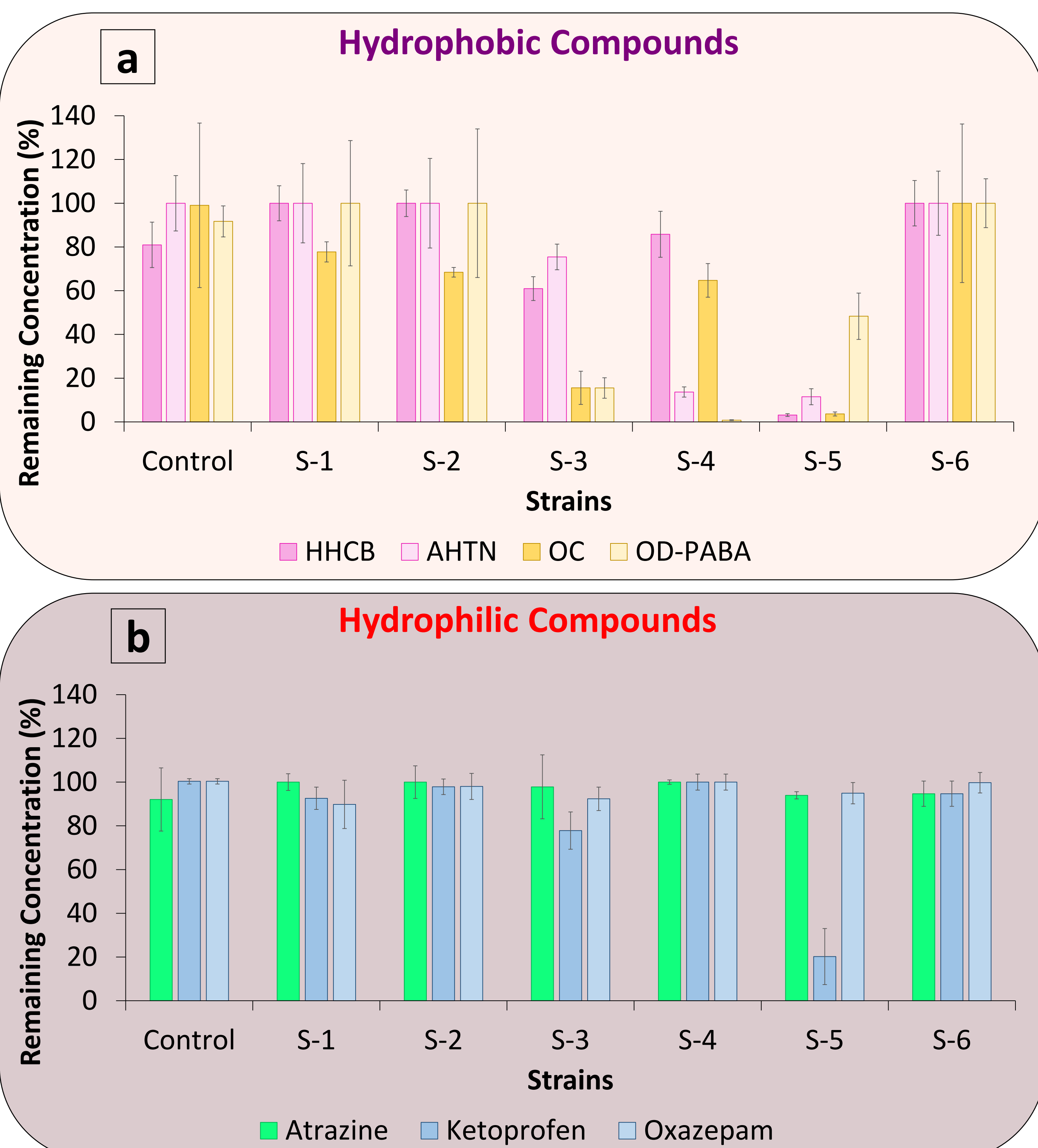


Fig 2. Remaining concentration percentage of hydrophobic (a) and hydrophilic (b) compounds degradation using selected isolated strains. Abiotic control was performed without inoculum in medium MM₂₀. Initial exposure concentration was 1 mg L⁻¹. Data are mean ± SD of three replicates.

Toxicity of CECs in Selected Bacterial Strains

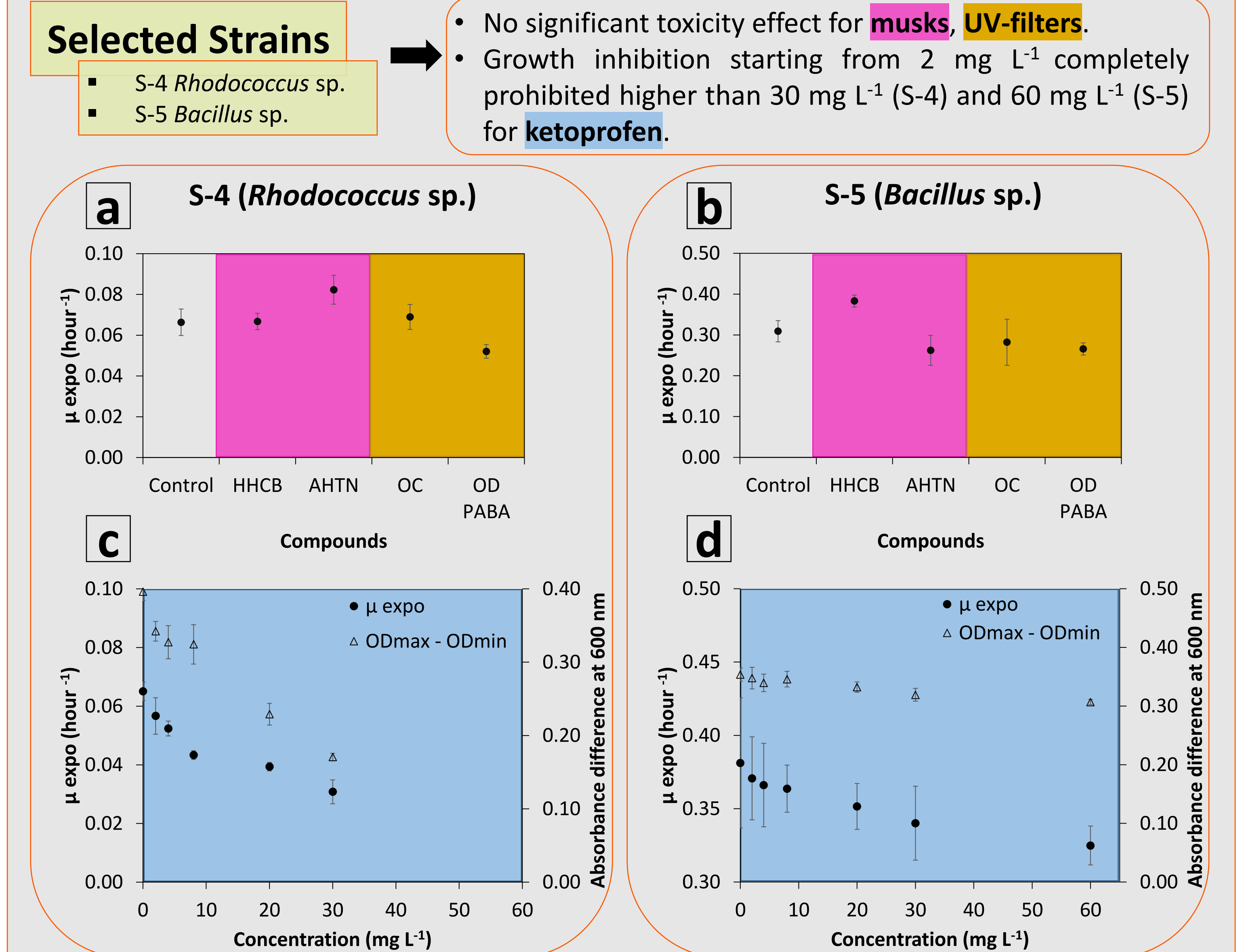


Fig 3. Exponential growth rate (μ_{expo}) (a and b (Kruskal-Wallis p value 0.3223 < 0.05 and 0.5804 < 0.05) in presence of synthetic musks and UV filters at 500 mg L⁻¹; c and d in presence of ketoprofen with production ($OD_{\text{max}} - OD_{\text{initial}}$) measured at 600 nm as a function of concentration by S-4 (a and c) and S-5 (b and d). Abiotic control was performed without inoculum in MM₂₀ medium.

Conclusions and Perspectives

- Efficient degradation of various CECs by pure bacterial strains isolated from marine sediments
- Rapid removal of hydrophobic compounds compared to hydrophilic ones
- No relationship between the resistance capacity and biodegradation potential of the strains
- Need of genomic characterization of strains to identify their genetic involvement in CECs biodegradation
- Promising bacterial strains to study degradation pathways of CECs and to improve biotreatment processes

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