CHEMICAL AND TOXICOLOGICAL ASSESSMENTS OF ANAEROBIC DIGESTERS REMOVING EDCs

BRAUN Florence[1,2], DELGENES Nadine[1], CREUSOT Nicolas[3], AIT-AISSA Selim[3], LE MENACH Karyn[4], BUDZINSKI Hélène[4], HAMELIN Jérôme[1], PATUREAU Dominique[1]

[1]INRA, UR050, Laboratoire de Biotechnologie de l'Environnement, Avenue des Etangs, Narbonne F-11100, France -
[2]ADEME, French Environment and Energy Management Agency, 20 avenue du Grésillé-BP 90406, F-49004 Angers Cedex 01, France -
[3]INERIS, Unité Ecotoxicologie in vitro et in vivo, Parc Alata, F-60550 Verneuil-en-Halatte, France -
[4]Université Bordeaux 1, Environnements et Paléoenvironnements Océaniques et Continentaux EPOC - UMR 5805 CNRS, Laboratoire de Physico- et Toxico-Chimie de l'environnement (LPTC), Bâtiment A12, 351 cours de la Libération, Talence , F-33405, France.

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INTRODUCTION

Urban sludge is often contaminated by organic pollutants such as polycyclic aromatic hydrocarbons (PAH). **Biodegradation under methanogenic conditions** was already reported for PAH [1]. However, the potential of degradation relied on the compounds availability, depending on both the organo-mineral composition of the sludge and on the intrinsic performances of the microbial populations. We investigated the influence of 3 microbial communities with **contrasting pollution history (PAH contaminated soil, PCB contaminated sediment, anaerobic sludge)** on **13 PAH removal**, their **distribution** in each physical compartment (aqueous, particulate) and their **endocrine disrupting activity** while physico-chemical conditions are strictly controlled.

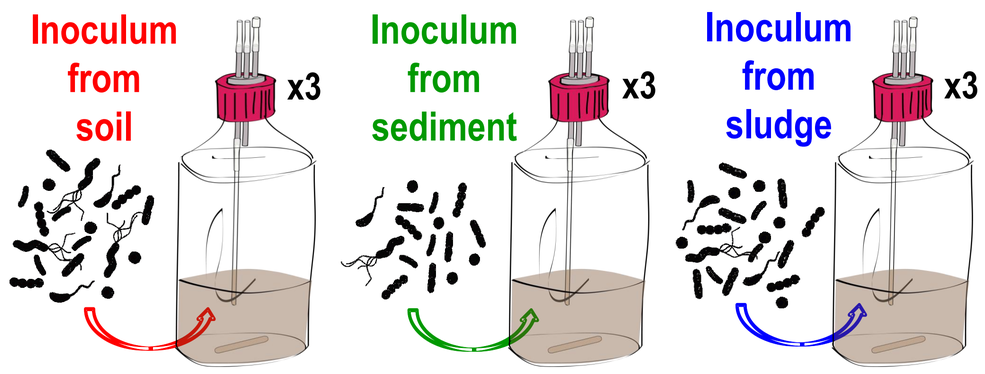
MATERIAL & METHODS

9 anaerobic reactors were operated at 37°C with a hydraulic retention time (HRT) of 20 days.
The inoculated microorganisms were extracted from **3 ecosystems** (**soil**, **sediment**, **sludge**) [2].
The **sterile** feed was a sludge **spiked with 13 PAH and 7 PCB** (5 mg.kg^{-1} DM) and **NP** (100 mg.kg^{-1} DM).

→ **Monitoring**: biogas production, biogas composition, dry matter and volatile fatty acid concentrations, chemical oxygen demand, PAH concentrations.

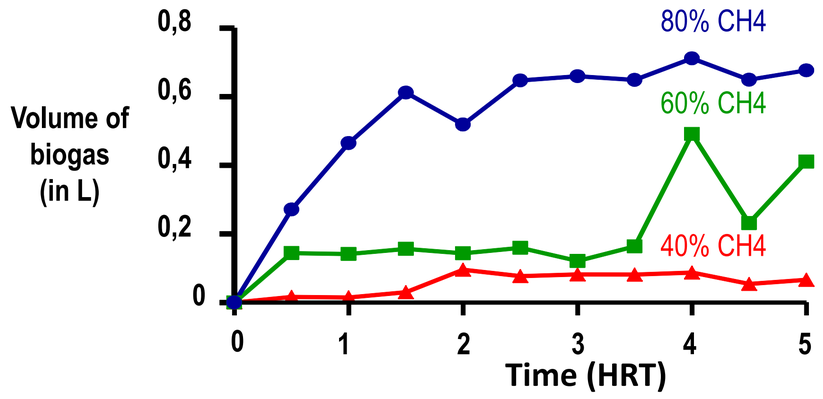
→ **At steady state**: measure of PAH concentrations (in total and particulate compartment by ASE-HPLC and in aqueous compartment by SPME-GC-MS [3]).

Measure of PAH-like activity *(in vitro* bioassays) in total, particulate and aqueous compartments.
The bioassays are based on the ability of PAH-like compounds to act through the AhR signaling pathway [4].



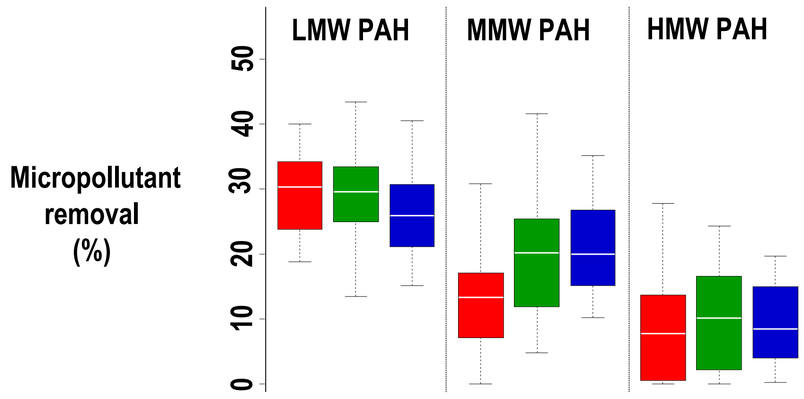
MAIN RESULTS

1) Different metabolic pathways



Biogas production over 100 days and methane proportion at steady state according to the origin of the inocula (**soil**, **sediment**, **sludge**) [5].

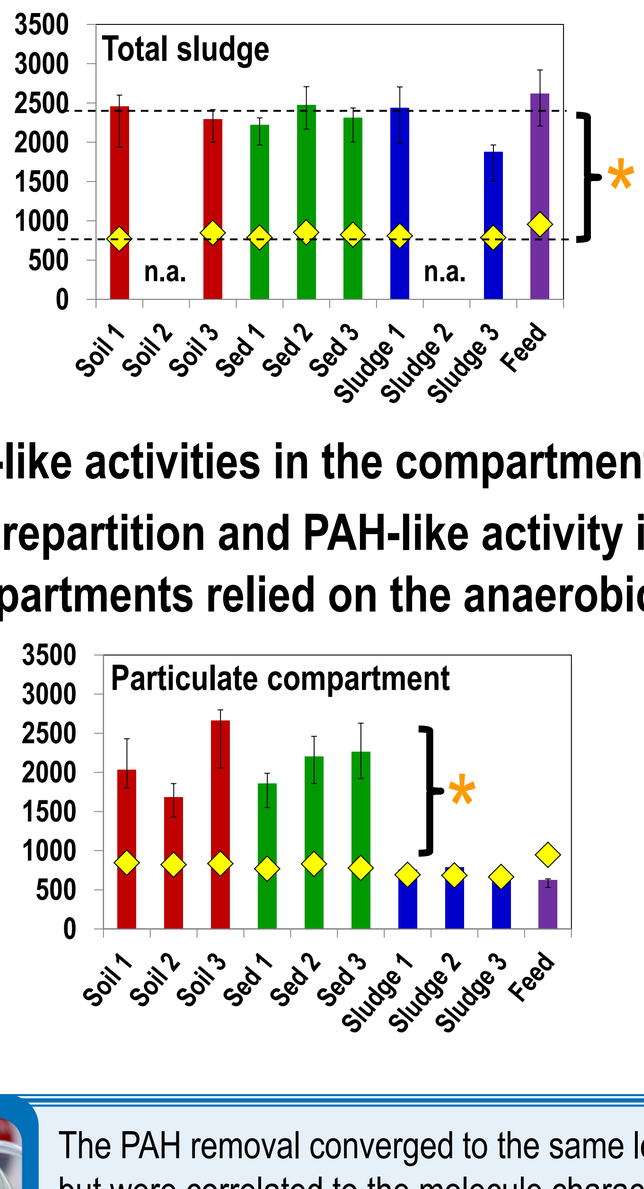
2) Same PAH removal rates whatever the inoculum and the metabolic pathway



The PAH removals at steady state are correlated with the molecule characteristics [5].
MW: molecular weight (L: low, M: medium, H: high).

3) In total sludge, same PAH-like activity between feed and digested sludge

PAH-like activity in BaP-EQ (µg/L)

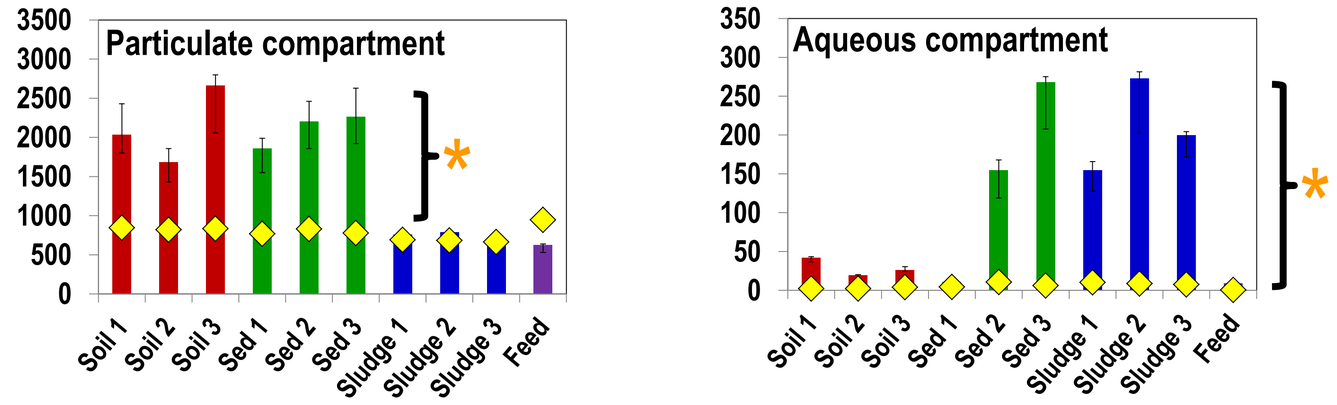


The PAH-like activities calculated by PAH chemical concentrations (◆) don't explain the totality of **the biological activity measured** at steady state for the 3 inocula (**soil**, **sediment**, **sludge**) and **feed.**

(*) Presence of **PAH by-products** or other compounds that interact with AhR receptors.

4) PAH-like activities in the compartments linked to the metabolic pathways

5) PAH repartition and PAH-like activity in the particulate and aqueous compartments relied on the anaerobic digestion level



Take-Home Message

The PAH removal converged to the same level, regardless of the inoculum or the metabolic pathway but were correlated to the molecule characteristics.

PAH repartition and PAH-like activity in the sludge compartments depend on the digestion degree of the organic matter. Other compounds or PAH degradation by-products maintained the global PAH-like sludge activity.

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