

PhD position

Capture of Biomethane by Enzyme Absorption and Biotransformation

- Laboratoire de Chimie Agro-industrielle LCA, Toulouse -
- Toulouse Biotechnology Institute TBI, Toulouse -

Funding Institut Carnot 3BCAR for 3 years

Start from first march 2022

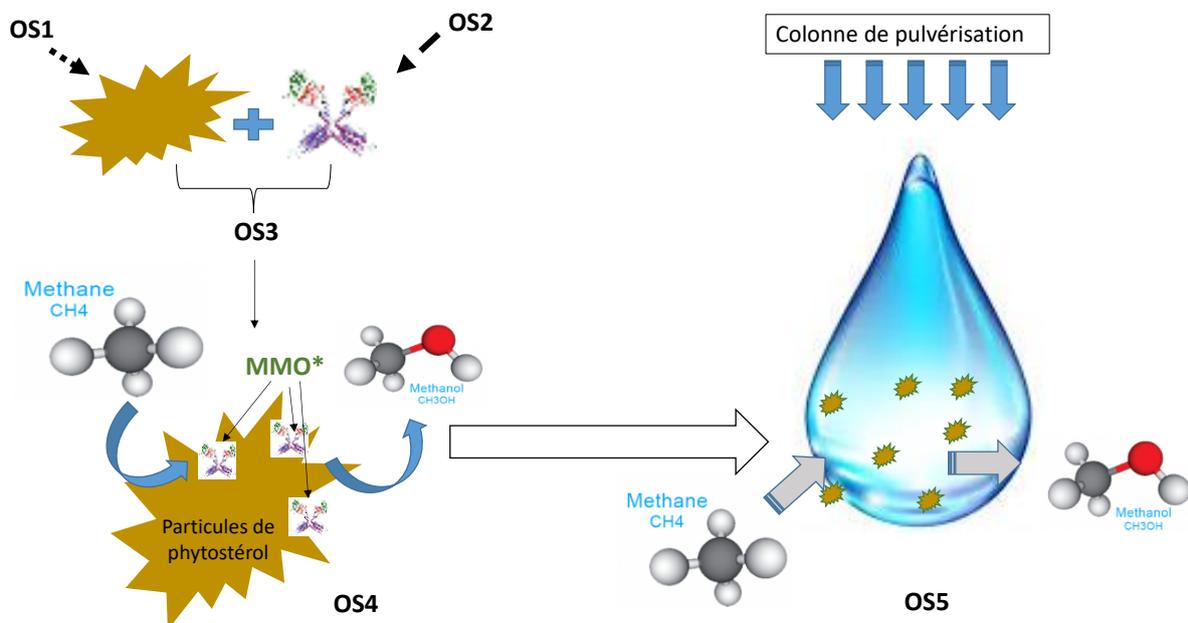
Application deadline **January 31, 2022**

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Application: Send a CV, transcripts (M1 + M2), and a letter of recommendation to contact persons.

The context of the thesis is that of the CH₄ biogas sector in France and the technological development of 'clean' processes that limit CH₄ releases in the atmosphere. The problem is that **of minimizing bioCH₄ residues in the bioCO₂ vents produced during the upstream CO₂ / CH₄ separation steps.** With this thesis, we propose to explore an innovative technological path based on the *in situ* coupling between the **capture of CH₄** and its **biotransformation** into methanol.



The work is first based first of all on **the synthesis and shaping of new absorbent phases** of CH₄ from bio-based products (phytosterols, **specific objective OS1**). It also requires the production of hybrid and easily purifiable **methanotrophic methane monooxygenase (MMO, OS2)** enzymes such as recently described in the literature¹. The main idea (**OS3**) then consists of **combining enzymes and phytosterol**



particles by physical or chemical immobilization, in order to build objects capable of both capturing CH₄ and transforming it into methanol. The capture and **transformation efficiency** of these objects will be measured in simple gas-liquid interface configurations, at the bench scale (**OS4**). We also imagine going as far as a first implementation on a semi-pilot scale via - for example - the spraying of an aqueous suspension of these active particles in vents representative of the situations encountered in the biogas plant (**OS5**).

The proposed work is clearly **interdisciplinary**, with experiments in synthetic chemistry, the production and purification of proteins, catalytic tests, a set of physico-chemical characterizations and finally experiments on a larger scale on semi-pilot installations. **The supervisory team** (Romain Valentin (LCA), Antoine Bouchoux (TBI), Stéphanie Heux (TBI), Gilles Hébrard (TBI), Claire Dumon (TBI)) is made up of researchers whose skills are complementary and cover all the concepts and techniques discussed.

The candidate should have **skills in the physico-chemistry of proteins and / or lipids** and some knowledge of **enzymatic processes** in general. Experience in **process engineering / biotechnology** would also be appreciated.

Depending on the tasks and progress of the thesis work, the doctoral student will have to spend time on each of the lab sites: Laboratoire de Chimie Agroindustrielle (LCA UMR 1010 INRAE / INP-ENSIACET) and Toulouse Biotechnology Institute (CNRS, INRA, INSA, Toulouse). The financial support is for 3 years and for a gross salary of around 1800 € / month.

[1] Kim, H.J., Huh, J., Kwon, Y.W. et al. Biological conversion of methane to methanol through genetic reassembly of native catalytic domains. *Nat Catal* 2, 342–353 (2019). <https://doi.org/10.1038/s41929-019-0255-1>.