Sujet de thèse 2021 – Laboratoire M2P2 – Aix-Marseille Université - France

PhD Title: Mechanisms of interactions between organic and mineral matter (phosphates) during hydrothermal liquefaction of residual biomass: application to digestate from anaerobic digestion.

Research fields: Chemical Engineering, Thermochemical processes

Start: between October 2021 and January 2022 (PhD duration 36 months)

Grant type: French National Research Agency (ANR), project D2LIFE (AAPG, 2021)

PhD Directors:

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Host laboratory: Laboratory M2P2 UMR 7340, Waste and Wastewater Treatment Team, Technopole de l'Environnement, Aix-en-Provence (France), http://www.m2p2.fr/recherche-m2p2/technopole-arbois-156.htm

Candidate profile: We are looking for candidates who have obtained a Master's in Chemical Engineering / Process Engineering, and practical training acquired in a research laboratory or in industry. Skills in process modelling / simulation will be appreciated.

Please send detailed CV and motivation letter by e-mail to:

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PhD description

The project D2LIFE (funded by French National Research Agency (ANR), AAPG 2021) aims to understand the interactions between organic matter and phosphates during the hydrothermal liquefaction of residual biomass (*e.g.,* digestate, sewage sludge, manure, agro-waste). This knowledge will contribute to the development of a hydrothermal treatment process that integrates the recovery of phosphorus (P) with the production of biofuels, by concentrating P in a solid phase mainly composed of Ca phosphates which will be used as fertilizer.

In the frame of the D2LIFE project, this PhD aims to identify and describe the effect of the main operating parameters of the hydrothermal process (*e.g.,* temperature, pressure, reaction time, addition of reagents) on the kinetics and pathways of P conversion, and on the partition of P among the aqueous, oily and solid phases resulting from biomass liquefaction. The methodological approach is based on hydrothermal liquefaction experiments carried out in a batch reactor, working at high pressure and temperature, using a real substrate (digestate from anaerobic digestion of sewage sludge), followed by modelling of the experimental results. The aqueous, oily, and solid phases resulting from digestate liquefaction will be separated and characterized in order to quantify the main forms of organic and inorganic P. The results will allow to identify the effect of the operating parameters of the hydrothermal process on the conversion pathways and on the partition of P among the different phases, and finally to develop a model that describes P conversion during hydrothermal liquefaction of digestate.

Keywords: residual biomass, phosphorus recovery, hydrothermal liquefaction.