TITRE DE LA THESE: Anaerobic digestate into bio**C**har/**C**har for **UR**ban storm**WAT**er management (ACCURWAT)

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Equipe(s) de recherche : TEAM et VERTE

Département(s) IMT Atlantique : DSEE

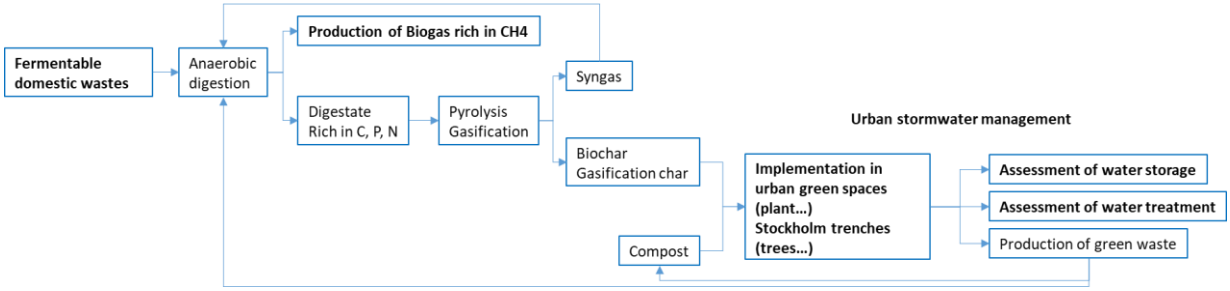
S'agit-il d'une thèse en cotutelle internationale ?
Oui
Si oui, organisme avec lequel la cotutelle est envisagée : Unibz

Le sujet proposé présente-il un caractère interdisciplinaire ?
Oui
Ce projet de doctorat vise à étayer les connaissances du biochar/char en tant que média destiné à un retour au sol. Cela fait nécessairement appel à la connaissance des procédés de transformations de biomasse (biologique, thermochimique) mais également à la caractérisation de matériaux poreux utilisés comme adsorbants de polluants présents dans les eaux de ruissellement urbain et comme support de croissances des plantes (capacité de rétention d'eau, puits de nutriments…). Ces études sont réalisées avec l'objectif d'accroitre la circularité des produits et de flux, à l'échelle urbaine.

La source du co-financement est-elle identifiée ?
Oui
Si oui, préciser quel co-financement est envisagé : demi-bourse IMTA +demi-bourse Unibz

Autres informations :
Informations utiles que vous souhaiteriez communiquer (si pertinent) :

Contexte ou état de l'art scientifique :
The PhD work is described as follows:



This work is at the crossroads of several issues related to urban sustainable development:

- the recovery of biodegradable waste (domestic or industrial, animal manure…) by anaerobic digestion leads into a methane-rich gas and a solid residue (digestate). After epuration, the biogas produced can be used as a substitute for natural gas or as transport fuel, while the digestate due to its chemical composition, currently poses an environmental and economic problem. A promising solution is the pyrolysis/gasification of this digestate in order to produce biochar/char, and syngas. The syngas is then recycled in the anaerobic digestion process to increase its methane content
- the circular economy of the so-called biochar/char is today driven by the carbon market but one the targeted applications as carbon sequestration in soils still needs to be investigated in terms of real benefit to the environment (safety, water retention, nutrients sink...)
- the urban stormwater management : due to the climate change combined with the increasing waterproofing of urban surfaces, heavy rain management at urban scale are more and more complex, rainfalls being more variable and sometimes very high. In addition, to face to water scarcity is concerned and not only confined to the dry climate areas, it would be beneficial to assess if biochar/char exhibit the expected properties of water storage and water treatment. This would also contribute to the development or urban green areas essential to combat heat islands, to contribute to the development of biodiversity and to improve the well-being of urban life.

Objectifs de la thèse :
The challenges to be raised are the followings:

- To optimize the anaerobic digestion in order to keep enough lignin content in the digestate for further biochar/char production, to identify the fate of N and P and to identify the optimum humidity required in the biodegradable waste
- To investigate in what extent, the syngas recycled in the anaerobic digestion process can increase the methane fraction of the biogas
- To increase the knowledge of biochar/char and identify their benefit in terms of adequacy for urban water runoff treatment and water storage
- To investigate the feasibility to use biochar/char in urban green areas or Stockholm trenches combined with their properties required to allow the plant growth (retention of water, nutrients sink…)
- To develop as much as possible the circularity of products and streams at urban scale

Compétences attendues du ou de la candidat·e :

- Scientific knowledge in chemical engineering or environmental engineering, combined with energy engineering, skills in scientific writing
- Practical knowledge: experimental work in laboratory, data analysis and modelling
- Intrapersonal competence: analytical and synthetic skills, rigour
- Fluent in English