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ECL_LTDS_KACEM_01

PhD Proposal 2017

School: Ecole Centrale de Lyon	
Laboratory: Laboratoire de tribologie et Dynamique des Systèmes (LTDS)	**Web site: http://ltds.ec-lyon.fr/spip/**
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Collaboration with other partner during this PhD: **In France: Ecole des Mines de Saint Etienne**	**In China:**

Title: **Optimization of a slag soil composition for Carbon capture**
Scientific field: environment and energy
Key words: CO2 sequestration, slags, urban soil, carbonatation

Details for the subject:

(Maximal length of 2 pages, including images, list of reference, …The pdf file should not exceed 1Mo)

Background, Context:

Excess carbon dioxide (CO_2) in the atmosphere affects the ecosystem as a greenhouse gas. Carbon dioxide may be reduced through lowering fuel emissions and carbon usage. In addition to reductions in emissions and to mitigate this condition, it is important to consider mechanisms that can remove CO_2 from the atmosphere. There are two main forms of soil carbon sequestration. First is geological storage, which is defined as subterranean injection of CO_2 such as below the salt domes, or within a depleted oil reservoir. The second form of carbon capture is passive soil sequestration, which will be the subject of this study. Soil carbon capture involves natural processes that remove atmospheric CO_2 through photosynthesis and pedogenic carbonates minerals. Some research were investigated in the world about this method. The work of Washbourne et al. (2012) at showed that the urban soils can remove 100 t CO_2 per hectare monthly.

Formation of pedogenic carbonates, (predominantly composed of the mineral calcite ($CaCO_3$)), depends on the availability of calcium and carbonate in solution. Carbon dioxide precipitation from soil that contains metallurgical slag into calcite may be maximized through material additions and foliage. Within the metallurgical slag, there are carbonate, silicate, and magnesium oxide that are often utilized to react with the carbon dioxide. The maximum CO_2 intake occurred at the highest temperature and smallest grain size for several different types of slag and intake quantities. Concentrations of mineral calcite on slag soil were measured in different soils and show the increase of the $CaCO_3$ in the soil (fig1).

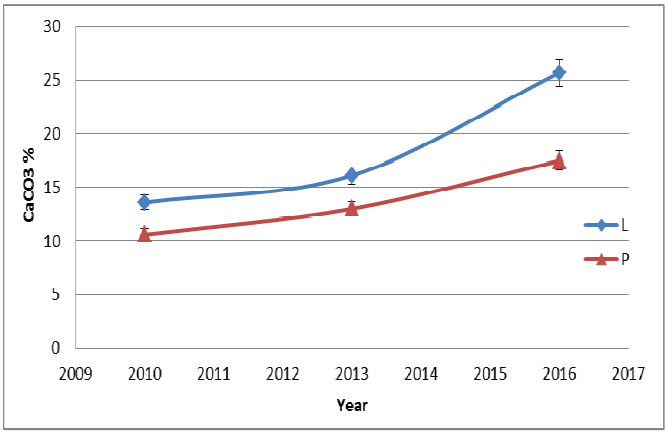

Fig1. The $CaCO_3$ in soils L and P from 2010 to 2016

A good evaluation of the use of soil need to know what controls the maximum amount of carbon can be captured in as soil. Investigation is needed to evaluate soils characteristics. A good control of all factors can help to develop the CO_2 capture by urban soil.

Research subject, work plan:

The goal of this PhD work is to give the method to use to have an ideal soil to use on the CO_2 capture. During this work, the carbon capture process will performed to determine the characteristics that would enhance the quantity of capture as well as the speed of the reaction.

Soil samples, predominately made up of slags, will be tested. At first, the pedological characteristics and the calcite content were determined.
From results of the first step a relationship between characteristics and carbon capture capacities will be identified. This work can define an "optimum soil" which can give a better CO_2 capture.
The last step is testing the use of the optimum soil as an urban soil will be tested.

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