CERIS Civil Engineering Research and Innovation for Sustainability

BIOCO2 – CCS-CCU Carbon Footprint Reduction using Biowaste (Task 4, concrete production)

Summary

The project "CCS-CCU technology for carbon footprint reduction using bio-adsorbents" called BIOCO2 is implemented between 1/10/2019 - 30/09/2022 under the International Academic Partnership Program from the funds of the National Agency for Academic Exchange (NAWA). The project includes the establishment of an international academic partnership in the scope of carbon footprint reduction by using CO2 from energy and other industries, as well as biomass, including biomass from municipal waste, and producing useful products using renewable energy. The subject is extremely important due to the need to reduce anthropogenic CO2 gas emissions.

The aim of the project is to undertake long-term scientific cooperation implemented as part of the international academic partnership initiated by the Czestochowa University of Technology, Poland (CUT) with universities and research institutes from Spain, Italy, and Portugal.

Therefore, this project shall provide results within the fields of scientific research and knowledge exchange. The project has been developing scientific research and knowledge exchange, carried out within the framework of an international academic partnership (Figure 1). These actions include, joint research between leader and partners and organization of workshops, lectures and study visits. The results shall provide a foundation for the development of a lasting cooperation of entities forming the partnership.

Figure 1. Team members from CERIS and CUT during a joint meeting in IST, Lisbon.

Regarding scientific research, the project has produced results addressing the possibility of combining several Carbon Capture and Storage (CCS) and Carbon Capture and Utilisation (CCU) technologies, taking into account the possibility of using waste products. The project involves the use of waste biomass for the production of biochar and biogas, which is then used for the production of activated carbon, widely used in industry, and as an alternative fuel such as DME. On the other hand, captured CO2, can be used to produce DME in the event of hydrogen supply and can be also stored in CO2 enriched concrete products (Figure 2). The determination of carbon footprint reduction, and an estimate of the production costs of individual substrates as well as materials was carried out (Figure 3).

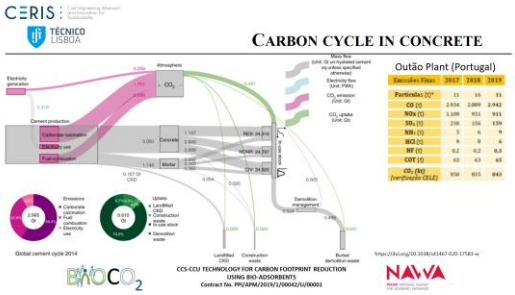

Figure 2. Carbon cycle in concrete.

Figure 3. Team members from CERIS and CUT during a study visit to Construction Materials Lab, DECivil. Acrylic carbonation chamber on the right.

The knowledge exchange will allow cooperation between the partners whose research topic covers the fabrication of materials/goods, for which production the substrate is necessary, which in turn is a product provided by another partner. This approach will allow to assess the integration of the production of goods through the use of wastes, such as CO2 and waste biomass. The results of the project will also allow for defining the scope of further possibilities of mutual cooperation.

The main outputs of the BIOCO2 – Task4 project in terms of dissemination are: 2 papers in peer-reviewed international journals and 1 book chapter (submitted and in review process) and 5 papers in international conference proceedings (4 already published and 1 already accepted). 1 PhD thesis (ongoing – A. Silva) and 2 MSc dissertations are assigned to the task.

Project Reference

PPI/APM/2019/1/00042/U/00001

Leading Institution

CUT – Czestochowa University of Technology (Poland)

Partners

IST – Instituto Superior Técnico (Portugal), CERIS – Civil Engineering Research and Innovation for Sustainability (Portugal), CSIC-INCAR – National Coal Institute (Spain), ITAE – Instituto di TecnologieAvanzate per l'Energia "Nicola Giordano" (Italy), UCBMR – University "Campus Bio-medico" of Rome (Italy)

CERIS Principal Investigator

Rita Nogueira (rita.nogueira@tecnico.ulisboa.pt)

CERIS Research Team

Inês Flores-Colen, José Alexandre Bogas, Vítor Sousa

Funding

NAWA – Polish National Agency for Academic Exchange

Period

2019-2022

Total

300 000.00€

CERIS

49 000.00€

Project Website

bioco2.is.pcz.pl/en