SCIENTIFIC AND TEHNICAL REPORT

STAGE 1 (1.07-31.12.2022)

Project PCE : Bio-based porous materials for hydrogen storage and environmental applications

(BIOPOROMAT)

PN-III-P4-PCE-2021-1455, Contract no. PCE 118/2022

Website: http://www.cercetare.icpm.tuiasi.ro/proiecte/BIOPOROMAT/2022_en/default.html

Coordinator: Gheorghe Asachi Technical University of Iaşi (TUIaşi)

Project manager: Professor Irina Volf

I. Short description of the 1st stage

Stage 1 of the BIOPOROMAT project consisted in 5 research activities. All of them were realized in time, which led to the achievement of the 2022 project objectives and overcoming the project results deliverables. The activities within this first phase were carried out in full and within the assumed deadline, leading to the fulfillment of the objectives for the year 2022 as well as to the achievement of the project indicators. A brief description of these activities is presented in the following paragraphs.

Act. A1.1 refers to the evaluation of the availability and types of biomass wastes and to chemical, morphological and structural characterization of some lignocellulosic biomass in order to have a realistic assessment on the valorization potential as well as on the pre-treatments of the feedstocks subjected to thermochemical conversion processes.

Considering the findings generated in this stage, the activity had as result the design of biomass wastes processing flow (feedstock, pre-treatments, conversion path) that will be integrated in a multi-stage protocol in order to obtain an innovative material with tailored properties which feature an organic core (CMNS) and a polymeric outer layer.

Act 1.2 presents 2 synthesis methods to prepare carbonaceous materials micro and nano structured through slow pyrolysis and hydrothermal conversion.

The experimental devices and facilities were adapted and work protocols were developed. Two laboratory-scale reactors, equipped with a heating system and temperature and pressure control were used in order to obtain CMNSs. In the same context, preliminary tests were carried out in an experimental configuration that allows thermal processing using a system equipped with a CO_2 laser and a displacement in x, y coordinates (Act 1.3).

As a result of experimental (Act 1.4), relevant data were obtained regarding the chemical, morphology and structural characterization of CNMS obtained in previous activities. Several advanced characterization methods including FT-IR spectroscopy, SEM scanning electron microscopy, Raman spectroscopy, TGA thermogravimetric analysis and dimensional analysis were used. Along with the preliminary evaluation of porosity characteristics (Act 1.5) as well as the estimation of the CNMS functionalization possibilities, all data generated in the first phase allow the design of porous materials with tailored properties adapted to the targeted applications in this project (environmental remediation and hydrogen storage).

III. Phase 1 results indicators

The project deliverables for 2022 are presented in table 1:

Table 1: Deliverables of the stage 1/2022;

No.	Deliverables	**Done**	**Expected**
1	Articles submitted to ISI journals (Q1)	**2**	**1**
2	Articles published in international data bases journals	**1**	**0**
3	Communications at international conferences	**3**	**0**
4	Kick-off meeting	**1**	**0**
5	Web site	**1**	**1**

A. Articles submitted to ISI journals (Q1)

1. Ungureanu G., Bejenari I., Hristea G., Volf I., 2022, **Carbonaceous materials from forest wastes conversion and their corresponding hazardous pollutants remediation performance**, paper submitted to Forests, Q1, IF 3.282.
Manuscript ID: forests-2061298; Type of manuscript: Article (under review).
2. Stan L., Volf I., Stan C.S., Albu C., Coroaba A., Ursu L.E., Popa M. **Intense blue photo emissive Carbon Dots prepared through pyrolytic processing of lignocellulosic waste**, lucrare trimisă spre publicare în revista Nanomaterials, Q1, IF 5,719.
Manuscript ID: nanomaterials-2094675; Type of manuscript: Article (under review).

B. Articles published in international data bases journals (BDI):
1. Armanu G.E., Volf I., 2022, **Natural carriers for bacterial immobilization used in bioremediation**, Bulletin of Polytechnic Institute of Iasi, Chemistry and Chemical Engineering section, 68 (72), 3, 109-122. http://www.bipcic.icpm.tuiasi.ro/2022_68_3.html

C. Communications:
1. Armanu G. E., Tofanica B.M., Volf I., 2022, **Measurement of key compositional parameters in three type of biomass wastes in order to define the appropriate feedstock for thermochemical conversion**, The 6th International Conference on Chemical Engineering ICCE2022, Advanced Materials and Processes for a Sustainable Development, http://www.cercetare.icpm.tuiasi.ro/conferinte/ICCE2022/pdf/ICCE2022-program.pdf
2. Armanu G. E., Tofanica B.M., Secula M. S., Mamaliga I., Volf I., 2022, **Predictive carbonaceous materials yields resulted from carbonisation in relation with the main components of the feedstock,** SICHEM 2022, Hydrogen the future energy and chemical engineering vector,
https://sicr.ro/wp-content/uploads/2022/11/SICHEM_Program_2022_v12.pdf
3. Asoltanei A.M., Iacob Tudose E., Secula M.S., Mamaliga I., 2022, **Effective diffusivity in porous spherical and cylindrical particles**, SICHEM 2022, Hydrogen the future energy and chemical engineering vector,
https://sicr.ro/wp-content/uploads/2022/11/SICHEM_Program_2022_v12.pdf

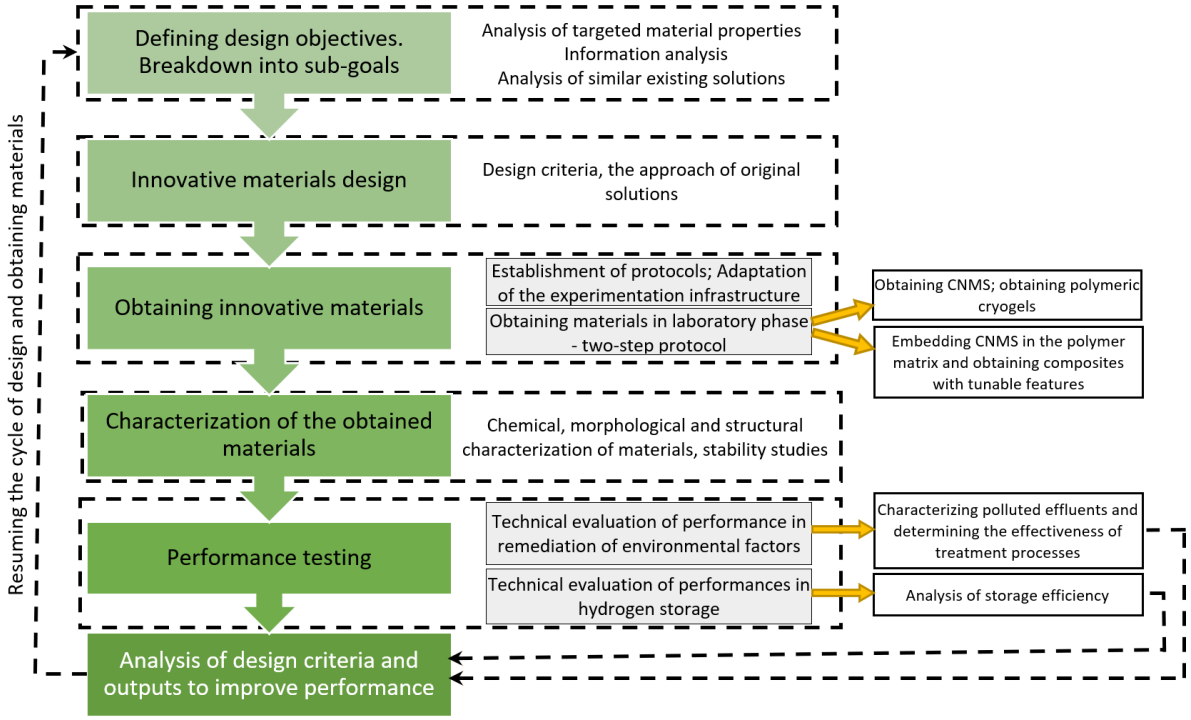
D. Workshop (11.07.2022).

E. Webpage:
http://www.cercetare.icpm.tuiasi.ro/proiecte/BIOPOROMAT/2022_en/default.html

II. Research activities in the 1st stage of the project

Act 1.1 - Experimental studies on proximate and ultimate analyses of feedstock and identification of suitable ones for CNMSs assembly. Assessment of the optimal pre-treatment techniques.
Act 1.2 - A.1.2. Preparation of micro/nanostructures by pyrolytic and hydrothermal processes.
Act 1.3 - Experimental study on the obtaining of CNMSs from biomass with a laser heat processing system.
Act 1.4 - Morpho-structural investigation of nano/ micro carbon structures obtained from biomass.
Act 1.5 – Lab scale studies on porosity tailoring and functionalization of prepared nano/ micro carbon structures.

Project concept:



The details of the project's achievement indicators can be found in Annex 1 to the scientific and technical report, on the web page dedicated to the project and on the UEFISCDI EvoC platform.

The activities within this first phase were carried out in full and within the assumed deadline, leading to the fulfillment of the objectives for the year 2022 as well as to the achievement of the project indicators.

Project Manager,

Prof. habil. Irina VOLF