BIOREACTOR FOR CONTROLLED/ADVANCED DEGRADATION OF POLYMERIC MATERIALS

Goal of the project

The main goal of the project is the development and implementation of an innovative technology that would reduce the impact of plastic waste onto environment. In this respect, a new technology of degradation based on a laboratory scale aerobic bioreactor will be designed. Plastic waste will be fed inside the bioreactor and would provide the carbon source necessary for the proliferation of bacteria. The polymeric material will be turned into compost after this biodegradation step, and would no longer be a threat for the environmental equilibrium.

Short description of the project

New technology of polymeric materials biodegradation inside a self-designed bioreactor fed with natural occurring bacteria or pure culture inocula. The biodegradation will take place in aerobic conditions, under continuous stirring and thermoset temperature, which allows the formation of microbial consortia.

Implementation period

01.02.2019 – 31.07.2020

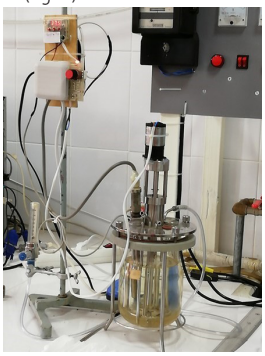
Budget

47.600 RON (10000 EUR)

Main activities

- A1.1. Design and testing of laboratory scale bioreactor. Process control parameters: temperature and pH.

The Bioreactor is made up of a sealed glass tank, with continuous stirring, thermoset unit, aeration device, sampling ports and pH monitoring systems (fig. 1).



- I.2. Air pumping system calibration. CO2 monitoring system

The air flow is provided by an air compressor and adjusted by means of a flowmeter. The air could be conducted through a HEPA filter system. The carbon dioxide is measured by an IR sensor mounted inside a separate cell.

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Results

- The tested glycopolymer displayed good biodegradation pattern inside the bioreactor. The weight loss was measured from time to time and kinetic modeling was performed in order to foresee the operating performances of the bioreactor. TG and FTIR analyses confirmed the structural modification of the glycopolymer samples during biodegradation. These findings were published as ISI articles and conferences.

Applicability and transferability of the results:

- 1. Pană A.M., et al.., Biodegradation studies on new glycopolymers derived from oligomeric D-mannose itaconates and 2-hydroxypropyl acrylate, Polym Degrad Stabil, 2019, 167, 210-216, I.F. = 3,78
- 2. Pană A.M., et al. Preliminary study on polymer degradation using an aerobic reactor, J Environ Prot Ecol, 2019, 20(4), 1951-1959, IF = 0.25
- 3. Pană A.M., et al.., Efficiency of an Aerobic Bioreactor for Glycopolymer Biodegradation, Proceedings of 9th International Conference on ENERGY and ENVIRONMENT (CIEM), IEEE Xplore, 2019, 129-132
- 4. Pană A.M., et al.., Preliminary study on polymer degradation using an aerobic reactor, Environmental Engineering and Sustainable Development, 7th Edition, June 20-21th, Alba Iulia.
- 5. Roman R., Pană A.M., Dumitrel G.A., Studii preliminare a biodegradării unor polimeri zaharidici utilizând un bioreactor aerob, Simpozionul Științific Studențesc al Facultății de Chimie Industrială și Ingineria Mediului, ediția a III-a, 14 Iunie 2019.

Research team

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