**Abstract**

The current project will address the development of a new equipment (MUST) to enable the intensification of processes involved in biorefineries through the combined use of ultrasounds and microwaves. This will be equipped with a unique system for transmitting microwave energy to the reaction medium (up to 2 kW), Internal Transmission Line, and an ultrasound power supply system with different frequencies (200 kHz to 1100 kHz) and adjustable powers. The possibility to adjust the ultrasounds frequency and power will increase the range of possible applications of the equipment.

Due to the metallic construction of the reactor and its double jacket through which a coolant can circulate, an extremely important desideratum can be achieved especially for the biomass treatment processes: the possibility of using high-power densities (of the order of 1-2 W/mL) while maintaining a low temperature of the reaction medium.

The efficiency of the new reactor will be evaluated through three different processes:

• Extraction of liposoluble principles from plants (carotene, lycopene, etc.) in the presence of a new biodegradable and biocompatible solvent (e.g., ethyl esters of fatty acids - FAEE) to obtain new compositions for food supplements.

• Obtaining polyol type compounds from biomass resources and uses in the manufacturing of quality polyurethanes;

• Synthesis of calcium alginate in the presence of microwaves and ultrasounds, as an environmentally friendly heavy metal ion exchanger.