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HABILITATION THESIS

The Impact the treatments applied to the soil (as well as) the technologies of biomass conversion have on the environment

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ABSTRACT

The introductory part brings to the attention relevant and concise information regarding my professional expertise as well as the research work I have done up to the time of accomplishing my habilitation thesis. The habilitation thesis entitled *‘The Impact the treatments applied to the soil (as well as) the technologies of biomass conversion have on the environment’* is structured on two main areas of research as follows: a) The way in which the treatments meant for the protection and development of plants impact the environment and b) Biomass conversion using environmentally friendly technologies;

The first chapter is a continuation of my doctoral dissertation „*The Impact of Plant Protection Products on the Quality of Grapes and Wine*” and it describes my research regarding the influence of dithiocarbamates used in the phytosanitary treatments of the microelements present in the soil of the Tohani- Dealu Mare grapevine plantations in Romania. I have also researched the impact on the soil properties and the influence of the phytosanitary treatments carried out as well as the effect of the weather conditions on the zinc amount in the wines of the Romanian Tohani vineyards. The chapter also deals with the monitorization of the splitting of the dinocap in soil, wine and grapes samples also considering the chelate effect of glyphosate, a broad-spectrum herbicide, on the plant absorption of micronutrients.

The second chapter comprises the research done regarding the use of sewage sludge, as a fertilizer for the soil of a variety of such crops as the corn crop (*Zea Mays L.*) and the oats crop (*Avena sativa L.*), the Someșan variety. At the same time, the chapter consists of the description of the technology of obtaining humic structure fertilizers in the production of which lignin and molasses have been used as raw material, these two byproducts being obtained during the process of refining cellulose and sugar. As a result, two biorenewable byproducts in low demand on the market have been put to good use.

The third chapter concentrates on several green chemistry strategies through which plant debris is utilized to obtain adsorbents meant to clean certain secondary fluxes. It has been demonstrated that black tea residue might be efficiently used as a bio-adsorbent to cleanse polluted waters from nitrates. Carrot residue is also a low-cost, friendly, biodegradable produce with a high bio-adsorbent potential in eliminating heavy metals from residual waters. Among the results presented in this chapter there are the highly depolluting capacities of orange-peel-based adsorbents used in

the purifying processes of water. Furthermore, their has been studied the biomass waste (from apples and potatoes) which demonstrated a high potential in obtaining biochar.

The second part of the thesis concentrates on the transformation of biomass into value added compounds by utilizing environmentally friendly technologies (chapters 4 and 5). Therefore, chapter 4 focusses on the study of obtaining a bio-component for liquid fuels through the digestate pyrolysis. The pyrolysis process has been studied in the presence of two catalysts. Moreover, the chapter has studied the improvement of the features of the bio-oil obtained through the digestate pyrolysis by means of a catalytic hydrotreating process in which a bimetallic, bifunctional catalyst was used. There have been investigated the influence of temperature and pressure on the conversion of the bio-oil and on the amount of oxygen in the resulted fuel.

Chapter 5 investigates the process through which fructose turns into methyl levulinate (ML), an oxygenated compound used for such fuels as gasoline. The process developed in the presence of a bifunctional catalyst improved for correcting the acidity. In the optimum reaction conditions, there waste can be best exploited with a view to obtaining oils with a high content of polyunsaturated fatty acids ω -3 și FAEE (biodiesel).

In the final part of the thesis I was preoccupied with presenting the courses of research due to develop in the future as a result of the experience I have accumulated during my scientific endeavour.–Topics such as: a) Research on the processing of biorenewable raw materials, with different lignin and cellulose content (cereal straw, oil or sugar plant stalks, by-products resulting from vegetable oil refining, etc.) through environmentally friendly technologies; b)Research on the rehabilitation of lands contaminated with heavy metals by producing energy crops used in the development of circular biorefinery processes; c)Research on the development of controlled release methods of fertilizers in order to reduce groundwater contamination, reduce specific fertilizer consumption and implicitly reduce greenhouse gas emissions;

As Henri Coanda once wisely said, *`Often, INTELLIGENCE is what is essentially necessary in human activity. But the unlimited potential of human intelligence can be attained only through relentless perseverance. Always remember that trying is not everything. You should never abandon what you have started half- way, but keep struggling to the end.`*