



Habilitation to conduct research

**Recycling biodegradable organic wastes in agriculture.
Assessment of the effects on agro-ecosystems and the environment.**

THESIS ABSTRACT

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The population growth, the industrial revolution and the development of a consumer-oriented society are the main causes for the global increase of organic waste (OW) amounts. The term *organic wastes* comprises a series of by-products and secondary products from agricultural and food production (crop residues, animal manure, slaughterhouse and agri-food processing wastes etc.) as well as from other human activities such as sanitation services (e.g. organic fraction of household wastes) or wastewater treatment (sewage sludge) etc. The organic wastes are secondary products or by-products generated by different production processes, and this name (OW) is given in order to differentiate them from the primary products.

Given that the organic waste amounts increased, the pressure on producers regarding the way such wastes are disposed of in the environment also increased. The use of animal manure as fertilisers for agricultural soils is a very old practice. Also, some of the by-products from agri-food industry can be used as organic fertilisers and/or amendments due to their high content of organic matter and nutrients. A series of other industries (e.g. wine production industry, distilleries, oil production industry etc.) can generate large amounts of liquid and solid wastes whose recycling and/or disposal is a problem for the environment. Sewage

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sludge is a very complex composition waste that requires an integrated approach for its management. For a long time, at European level and worldwide, the sewage sludge was recycled as fertiliser for agricultural soils, this being regulated by the Directive 86/278/EEC, as well as by the laws and regulations of each European State Member. Regarding household wastes, the current trend of the European policy is to reduce their storage by reconsidering them as potential resources, including energy production.

As a result of the implementation of the Directive on urban wastewater treatment (91/271/EEC), at European level, the sewage sludge amount increased significantly. According to reported research, with an estimated production of 100 g dry sewage sludge daily per inhabitant, in 2001, the European Community (EC) could generate about 14 million tonnes of such waste. As European Union Member, Romania has to implement the European regulations on organic wastes (sewage sludge, household wastes, animal wastes etc.).

Currently, in Romania, it's not the organic waste production that worries most, but the combination of high productions with the inconsistency and incoherence of an integrated and sustainable management. In such circumstances, it is possible to produce disturbing effects on the environment (e.g. nitrate and phosphate pollution, heavy metal or other substances pollution, contamination with pathogens, atmosphere pollution with greenhouse gas emissions, as well as agricultural land pollution and degradation by storage and/or uncontrolled application). These types of pollution can have domino effects on waters, plants, animals, biodiversity and humans.

Within this vast problem that organic wastes generate, in my research, since 1991, I have studied some biotechnologies for treating organic wastes in order to recycle them as fertilisers for agricultural soils, while maintaining a balance with the environment. In this approach I envisaged the sustainability of treatment methods, the sanitation of products resulting from the treatment, their agronomic impact (e.g. contribution of soil organic matter content, the effects on soil physical, chemical and biological properties etc.), as well as the impact on agricultural products (e.g. transfer of heavy metals in the soil-plant-animal system), on the environment (soil pollution with heavy metals, soil and plants contamination with pathogens, the effects of heavy metals on some species of microorganisms in the soil and on their population size and diversity etc.). Regarding the sewage sludge, some researches were oriented on establishing the correct rate of sewage sludge or compost from sewage sludge in order to achieve the agronomic objective on the one hand (increase of soil fertility, and the nutrients content that is necessary to achieve a certain crop yield), and the objective regarding

