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Municipal solid waste bio-drying before energy generation

Abstract of the doctoral thesis

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In the field of Municipal Solid Waste (MSW) management, the recent approach referred to the one-stream ***Biological Mechanical Treatment (BMT)***, represents an increasing option in Europe either as a pre-treatment before landfilling or as pre-treatment before combustion. That is in agreement with the new European directives concerning the valorization of materials and energy recovery.

Usually, in BMT plants, after a mechanical sorting and separation of the waste stream in biodegradable and non-biodegradable materials, the biodegradable materials are sent to a biological process, aimed to the generation of *Stabilised Organic Fraction (SOF)*. On the contrary the one-stream option avoids the preliminary separation before the biological stage and is named bio-drying when is aimed to decrease the humidity of waste thanks to the aerobic exothermic reactions which take place in the biological process. Post-treatment of refining can allow the production of ***Refuse Derived Fuel (RDF)*** used for alternative options: as a fuel for co-combustion in power plants and cement kilns, as a feedstock for pyrolysis/gasification plants, etc. Compared to the traditional two-stream approach, one of the advantages is the avoiding of generation of SOF, usually difficult to be placed for land remediation. The highest concentration of MSW bio-drying plants in the world can be found in Germany and Italy.

In November 2002 a study on the MSW bio-drying process began as a PhD activity in the Power Faculty of the Technical University of Bucharest (Romania). In September 2003 an international scientific collaboration between the Technical University of Bucharest and the University of Trento, Italy, was signed in order to go on with the development of the topic in the frame of a co-supervised doctorate, as in Trento a bio-drying pilot plant was available (at the Environmental and Civil Department).

The results, obtained referring to the bio-drying process, are listed below:

- experimental energy and mass balances;

- assessment of energy and mass balances for different scenarios;
- assessment for bio-drying role in MSW management;
- LHV modeling during the bio-drying process, both for bio-dried material and for RDF;
- volatile solid consumption modeling during bio-drying;
- waste humidity dynamics modeling;
- dynamics of Nitrogen compounds release, useful for assessing the necessary efficiencies of removal before emission to the atmosphere;
- understanding of PCDD/F release to air and PCDD/F emission factors assessment;
- criteria for environmental impact minimization;
- criteria for air flow management .