Environmental evaluation of a composting plant facility: bioplastic analysis, and environmental and economic life cycle assessment

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Within the framework of circular economy targets, compost production is one of the main players (Razza *et al,* 2018). Composting fully embodies principles of sustainability by transforming and recycling – under correct and specific conditions - organic waste that otherwise would be landfilled (Pergola *et al*, 2018).

The presented project focuses particularly on analysing in qualitative and quantitative terms plastic and bioplastic that inevitably enter the plant. It also evaluates the environmental and the economic footprint of a specific composting plant. To this end, a first mapping of Italian composting plants was undertaken, while a specific composting plant was selected as a case study.

The specific composting plant considered in the analysis is located in the Emilia-Romagna region (Italy). A material flow analysis was performed to identify the materials entering and leaving the plant.

Regarding the input materials, the plant treats 15000 tonnes of waste every year. The waste collection basin counts 49 different sites, of which 45 deliver organic waste. On the other hand, the output materials consist mostly of compost and in a smaller portion wood chips and compostable wood.

A more specific waste characterization analysis was developed in order to quantify and compare the amount of plastic and bioplastic entering and leaving the plant as part of the compost or as part of residual waste meant to end up in an incineration facility. The first step in conducting an urban waste analysis is to identify a representative waste sample, in which weekly and seasonal changes are considered. Subsequently, the waste is weighed and classified. In the presented project, the sample is represented by 1600 kg of fresh organic waste, which was quite homogenous thanks to a door – to – door collection. After applying the two quartering procedures analysis, 115 kg of waste were obtained and classified in four categories.
These results were then compared with 40 kg of the final materials after the composting treatment.

The comparison of the two analyses showed that the percentage of conventional plastic remains nearly constant. On the other hand, the amount of biodegradable plastic before and after the treatment changed drastically, almost completely disappearing in the composted waste fraction.

The second part of the project concerned an assessment of environmental and economic impacts of the considered composting plants by means of an Environmental Life Cycle Assessment (LCA) and a Life Cycle Cost (LCC) Analysis.

A Life Cycle Assessment is a very effective methodology, whose holistic approach can support decision - making processes to address further improvements (Cadena *et al*, 2009). For instance, LCAs studies have also proved that composting solution is more environmentally sound and therefore preferable to other organic waste disposal scenarios (Saer *et al* 2013, Andersen *et al* 2012).

In the considered case study, an economic assessment was developed by considering the waste transportation and maintenance costs of the plant. A peculiar focus was given to the plant management cost and to the costs required in order to correctly run internal machinery.

An environmental assessment was carried out within the same boundary to evaluate the environmental impacts of transportation of the waste from the collection sites to the composting facility and the related activities performed inside the composting plant.

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