How the wastes composition can influence flow sheet and management of a mechanical-biological treatment plant

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Abstract

In Italy, besides the separate collection (that is it is more widespread in the northern regions), part of waste management system is still arranged for mechanical-biological treatment (MBT) of the residual municipal solid wastes (MSW). From these wastes, it is generally possible to separate and collect different flows: metals, high-calorific materials and organic fractions. Therefore, the main objectives of an MBT plant are the mechanical sorting of these flows and the biological stabilization of the biodegradable wastes, in order to minimize the impacts connected with their disposal, as required by the targets of the Landfill Directive 1999/31/EC. It is very important to consider that the main characteristics of the bio-stabilized output of this kind of plants, strongly depend on the composition of the wastes that feed them: different fractions (as plastics and other not biodegradable scraps) can adversely contribute on the organic fraction treatment, by increasing the time needed for their complete and efficient biological stabilization [1]. Furthermore, also the configuration of the technologies that MBT plants have inside plays a key role on their efficiency.

This work aims to show how the needs of a mechanical-biological treatment plant could change over the years of operation, by considering the different composition of the wastes collected and treated in 2009 and the first half of the 2019. This study also exposed how it is possible to revert from these changing by adapting the plant setup to restore the biological stabilization efficiency.

By comparing the operating conditions in the years 2009 and 2019, it was observed:

- a reduction in the potentially biodegradable fractions (from 29% to 11%) composing the fed wastes
- an increasing in the paper and similar fractions (from 31% to 35%);
- an increasing in plastics fractions (from 22% to 40%).

These changes led difficulties in maintaining the proper operating conditions in the aerated basins, with a consequent worsening in the biological stability of the bio-stabilized output. Since the higher content of plastics and other scraps caused a slowing down of the degradation kinetics, leading to the incomplete biological degradation of the organic matter that was originally in the wastes, different solutions were evaluated in order to better separate plastics and scraps from the flows that is aerobically treated in the basins.

Above all, a change in screening of the wastes, just before their aerobic treatment was placed, modifying the primary mechanical treatment varying the mesh size of the screens of the primary separator with a 50 mm circular holes mesh.

Furthermore, the basins configuration was changed by placing the reactors in series and using a screening unit (25 mm) before transferring the stabilizing material from unit 1 to unit 2. In this way, after a primary aerobic biostabilization step in the first basin, the bigger scraps are separated from the materials with size that is lower than 25 mm, that are sent in the second basin. Here the organic fractions are biologically stabilized, by means of a about 30 day for the aerobic treatment. These changes also have simplified the management of both drying and stabilization steps, as evidenced by final DRI values.

Part of these changes were evaluated with a simulation model of the biological process, which made possible to define and identify the most appropriate interventions, the validity of which was also confirmed once the changes were implemented and the consequent surveys carried out.

Keywords: mechanical-biological treatment, bio-stabilised waste, residual municipal solid wastes