

Bio-waste management in EU countries: the role of composting and anaerobic digestion for the reduction of GHG emissions

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A proper bio-waste management represents a key element of the overall municipal waste management strategies both for effectively addressing our society towards a circular way of living life and, more specifically, for facing resource shortage and the climate change challenge.

The source segregation of kitchen waste, garden waste and other organic waste streams allows to strongly reduce the amount of waste to be disposed of (considering that 30 to 50% of the municipal waste generated is represented by organic waste), and to avoid that anaerobic methane generating processes occur in such an uncontrolled environment as a landfill, that is unable to efficiently produce, collect and exploit this gas, which is released to the atmosphere in important amounts.

ECN represents today around 4.500 biological treatment waste plants (composting and AD) with a treatment capacity of more than 45 million tons of bio-waste per year. With EU member states now obliged to collect bio-waste separately (or recycle it at source) by 31 December 2023, the bio-waste community in Europe is set to grow significantly.

Composting is the most widely adopted approach to bio-waste recycling (30,5 Mtons capacity, according to the last ECN status report, published in 2019), followed by anaerobic digestion, possibly integrated with composting (17 Mtons); all these options, when properly planned and managed, are able either to avoid or to highly efficiently capture and exploit the methane producible from the degradation of the putrescible fraction of bio-waste.

composting is a process that, by definition, requires the bio-waste to be treated under strictly aerobic conditions, in order to oxidize the easily degradable organic matter; in such conditions, methane production should be virtually negligible. A number of different composting technologies are put in place in industrial applications; according to the experience developed in Italy (one of the most advanced EU countries in terms of bio-waste recycling, with over 10Mtons throughput capacity, and some 340 facilities in operation), forcedly ventilated piles put under strictly monitored conditions (of temperature and O₂ concentration, used to finely tune the intensity of ventilation), often performed in closed reactors (biocells), is the most diffuse approach to the aerobic treatment of highly putrescible bio-waste. A 3-4 week active oxidation period, followed by a second biological step (curing) that can last up to 2 months, guarantees that in the final product (compost) only the more stable and humus like matter remains, representing a long term carbon storage - actually, a carbon sink - for soils, further improving the environmental performances of this recycling chain.

In an increasing number of facilities in operation, the active oxidation step of the composting process is being replaced by an anaerobic digestion step that allows the putrescible organic matter to be turned under controlled and optimized conditions into a methane rich biogas (instead of CO₂ and water produced by aerobic processes). Biogas is either turned into electricity (by means of a CHP unit) or, in more recent applications, split into a methane stream (subsidized in Italy as a renewable fuel that must replace the fossil based one) and a CO₂ stream, that can be exploited as a technical gas replacing industrial fossil based productions.

In the Italian context (but the same scheme is adopted in other EU countries), the digestate left by the anaerobic digestion step is immediately brought to aerobic conditions and undergoes a short-lasting composting step, that guarantees an environmentally safe production of compost.