



AEROBIC BIOLOGICAL TREATMENT OF FOOD AND GREEN WASTE FOR COMPOST PRODUCTION AND LANDFILL MINIMIZATION

TECHNOLOGY DESCRIPTION

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Food and green waste can be processed biologically using aerobic methods (composting). The purpose of the process is to convert biodegradable waste into compost that is safe for humans, animals and plants, and that is recyclable mainly as a fertiliser or soil improver. Aerobic treatment can also be used for biological stabilisation of waste prior to landfilling.

Aerobic biodegradation of waste is the natural biological degradation process in which bacteria that thrive in oxygen-rich environments break down and digest the waste into carbon dioxide (CO₂), water (H₂O), nitrates and sulphates. The key characteristics of the composting processes relate to the construction of the biological stage in which decomposition is the most intense. Three main composting techniques available are windrow, aerated static pile and in-vessel composting.

A further distinction is to be made with regards to how the composting plant and the windrow itself are built. The second distinguishing feature relates to the way that the composting plant operates. Plants can have active or passive ventilation systems, dynamic windrows (continuously turning, as in composting drums), semi-dynamic windrows (rotting material is turned or mixed by machines) and static windrows with forced aeration.

Supporting techniques include sorting, screening and curing. Each technique varies in procedures and equipment needs. Other variations of technologies are issues, such as air supply, temperature control, mixing and time required for composting. Moreover, their capital and operating costs also differ widely.

The simplest way of composting is the windrow compost process. It is associated with lowest capital and operating costs and affordable for present economic conditions in Ukraine. This process includes:

- The shredding of the green waste using a tub grinder;
- Moving the shredded green waste into long rows (windrows), using a loading shovel;
- Turning rows on a weekly basis to improve porosity and oxygen content, to mix in or remove moisture and to redistribute cooler and hotter portions of the rows.

CURRENT TECHNOLOGY READINESS LEVEL OR COMMERCIAL READINESS INDEX

Composting of municipal solid waste (MSW) is still not common practice in Ukraine. The overall level of MSW composting is low as soon as only 0.018% of waste were composted in 2018 by official data of the Ministry of regional development of Ukraine. However, this is at least one successful example of new commercial full-scale composting project in city of Lviv.

In relation to waste recycling and other recovery including composting, a key challenge is the lack of an organized system capable of efficiently collecting the secondary raw materials of high quality. Thus, technology readiness level for composting in Ukraine is considered as system prototype demonstration in operational environment, commercial readiness as commercial trial.



CLIMATE RATIONALE OF THE TECHNOLOGY

Greenhouse Gas (GHG) emissions in the Waste Sector in Ukraine amount to approximately 12 Mt CO₂-eq. It's the only sector where the GHG emissions upward trend has been observed since 1990. More than 65 % of GHG emissions in the Waste sector are caused by MSW landfilling due to under developed waste treatment technologies. It is expected that this share will increase constantly in future, if significant changes do not take place in MSW management practice in Ukraine.

Composting of waste reduces the amount of organic waste to be disposed of in landfills. This directly prevents methane emissions and therefore contributes to climate change mitigation. Methane is a GHG that is 25 times a more potent than CO₂ in terms of what would have occurred from waste disposal on land. The composting of one ton of MSW is approx. equivalent to 0.6 t CO₂-eq. GHG emission's reduction.

Additionally, the use of compost as organic fertilizer in agriculture produces less CO₂ emissions than the use of substituted mineral fertilizer.

AMBITION OF THE TECHNOLOGY

SCALE FOR IMPLEMENTATION AND TIME-LINE

The proposed level of MSW biological treatment's diffusion including composting should ensure 5% by 2030, 16% by 2040 and up to 20% by 2050. Such a level of ambition for composting (recycling) corresponds to implementation of Waste sector target scenario S3G stated in the NDC2 as well as to implementation of National Waste Management Strategy of Ukraine. The 5% share correspond approx. 500,000 tons of food and green waste.

Home composting units could be used in individual houses in suburban areas in cities and towns and in rural areas (approximately 2.5 million households in total). Small scale composting facilities could be used in any territorial communities of Ukraine. It should be mentioned that new administrative division of Ukrainian territory includes 1,469 Territorial Communities.

EXPECTED IMPACTS OF THE TECHNOLOGY

Producing compost is found to be a profitable business in many parts of the world, if it is implemented in the models of public private partnerships and the right choice of centralized and decentralized composting units. The technology is applicable for both small-scale and large-scale applications. Each of these supports the generation of local employment.

Composting provides benefits for waste handling companies. These companies increase the landfill's lifetime and the marketability of the product in the form of compost by introduction of composting for food and green waste. Composting projects are also associated with reduction of organic waste direct landfilling and minimization of the risk of dangerous methane gas concentrations in landfills and reduced exposure of residential areas to odour.

The economy of Ukraine is based on the agrarian sector among others. When farms utilize compost, the requirement to purchase chemical fertilizers is reduced which thereby results in reduction in human's and soil's health problems. The compost application in farm fields also results in economic benefits by enhancing the availability of nutrients in the soil for crops and improving the effectiveness of other fertilizers.

POLICY ACTIONS FOR TECHNOLOGY IMPLEMENTATION



EXISTING POLICIES IN RELATION TO THE TECHNOLOGY

The key challenge for composting is the lack of an organized system capable of efficiently collecting the organic waste of high quality. In Ukraine, there is the requirement of the progressive implementation of MSW separate collection and establishing the mechanism for the practical implementation of extended producer responsibility (EPR) principle, in order to improve the quality of secondary raw materials.

Another challenge is development of the market of organic fertilizers. This market including manure, compost of different origin, digestate from biogas plants, etc. practically does not exist. Development of the market of organic fertilizers based on wide use of compost together with implementation of waste separate collection would contribute to ensuring a proper balance of humus in the soil.

Existing economic and financial barriers are associated with low tariffs for waste collection, treatment and landfilling. It means that waste disposal is still the cheapest option of MSW management in parallel with low population income. Regulation/legislation barriers are associated with the lack of comprehensive and strategic energy policy implementation, insufficient institutional framework, over-bureaucratic procedures, the lack of control for unofficial landfilling and activities, and there are no incentives for organic waste separate treatment

Technical barriers are associated with low collecting efficiency of the high-quality organic waste and the lack of separate waste collection. There are also information barriers. They are limited awareness of technology, the lack of available information, pure knowledge to the population and involvement, and missing feedback among interested parties. There is also no culture of home composting in suburban and rural areas.

PROPOSED POLICIES/MEASURES TO ENHANCE TECHNOLOGY IMPLEMENTATION

In order to achieve the GHG emission target in the Waste sector, which was set up in the NDC2, the following main policies and measures are proposed to be implemented for dissemination of technologies for aerobic biological treatment (composting) of food and green waste:

1. The creation of necessary infrastructure:

- 1.1. The development of regional waste management plans on the basis of cluster structure (2021-2028)
- 1.2. The establishment of coordination council for research about waste reuse and processing (recycling) (2022-2023)
- 1.3. The creation of waste management registers and adoption of the decree of their maintenance (2022-2023)
- 1.4 The support of the development of inter-municipal cooperation (2021-2028)

2. The creation of economic and financial conditions for source separation and home and industry composting:

- 2.1 The introduction of high gate fee/tax for waste disposal and CO2 emission (2022-2024)
- 2.2 The creation of technical and economic condition for the use of compost as fertilizer and soil improver (2022-2024)

3. Provision of long-term and low-interest loans or grants through state funds, private sources and international funds:

- 3.1 Explore sources of funding (national and international agencies) (2021-2022)
- 3.2 Training in the development of proposal for funding (2022-2024)
- 3.3 The preparation of funding proposals to be submitted (2024-2030)

4. The creation of the stakeholder and technical expert networks for technology development and transfer:



4.1 The creation of the platform for national technical experts and stakeholders based on governed or non-government organizations (2022-2024)

4.2 Exchange information and lessons learned (info campaigns for population, workshops and conferences for experts and other interested parties (2024-2030)

COSTS RELATED TO THE IMPLEMENTATION OF POLICIES

Home composting units are being used in individual houses in suburban areas in cities and towns and in rural areas (approximately 2.5 million households in total) at an indicative estimate of EUR 105.5 million.

The cost of GHG reduction in enclosed, building with concrete floors, material recovery facilities (MRF) processing equipment and in-vessel composting; enclosed building for the curing of compost product would vary between 50 and 85 EUR per t CO₂-eq.

USEFUL INFORMATION

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LINKS TO TNA REPORTS

Reports prepared within the TNA Project:

- Technology Needs Assessment
- Barriers Analysis and Enabling Frameworks
- Technology Action Plan

Full texts of the TNA reports are available at: <https://tech-action.unepdtu.org/country/ukraine/>

TNA Project page at the web-site of the Ministry of Environment and Natural Resources of Ukraine:
<https://menr.gov.ua/news/33450.html>