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Sustainable Valorisation of the Organic Fraction of Municipal Solid Waste for the Production of Bio-Based Products

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Abstract

The increasing generation of Municipal Solid Waste (MSW) and the need to recover valuable resources from it have created a demand for management practices that go beyond conventional disposal. The “CircLandfill” project examined the use of the organic fraction of municipal waste as a raw material for the production of bio-based products. The study covered both the organic fraction recovered from mixed municipal waste and source-separated biowaste. The products investigated included biodegradable mulch films, adhesives for engineered wood products, and organic fertilisers or soil improvers. The project was implemented by a consortium of universities and companies with complementary expertise in the relevant scientific and industrial fields. The academic partners included the Agricultural University of Athens, which served as the scientific coordinator through the participation of two of its departments, Aristotle University of Thessaloniki, and the National and Kapodistrian University of Athens. The companies involved in the project were DEDISA S.A. (OTA), CHIMAR Hellas, and Achaika Plastics S.A. This combination of academic, industrial, and waste-management expertise enabled the proposed processes to be studied from the initial treatment of the waste up to their pilot-scale application. During processing, the organic feedstocks were used to produce a hydrolysate suitable for use as a nutrient medium for microbial fermentation. At the same time, a protein-rich fraction was recovered, while the remaining organic material was used for the production of an organic soil improver and biochar. The hydrolysate was subsequently used for the biotechnological production of succinic acid, which was converted into poly(butylene succinate) (PBS). The bio-based PBS was intended for the manufacture of biodegradable agricultural mulch films. The recovered protein fraction was also assessed as a renewable raw material that could partially replace conventional components in adhesives for engineered wood products. Rather than focusing on a single end product, CircLandfil combined several recovery routes within the same value chain. In this way, a larger proportion of the organic waste could be put to productive use, while reducing the demand for conventional petrochemical raw materials. The project was funded under the “SUB 1.1 Research Excellence Partnerships” programme of the Hellenic Ministry of Education, Religious Affairs and Sports.

Keywords: Organic Fraction of Municipal Solid Waste, circular economy, biorefinery, bio-based products