

SUSTAINEXT-Validating a Zero-Waste: Dynamic, MultivalORIZATION Route Biorefinery for Plant Extracts

Authors : Adriana Diaz Triana, Wolfgang Wimmer, Sebastian Glaser, Rainer Pamminger

Abstract : SUSTAINEXT is a pioneer initiative in Extremadura, Spain under the EU Biobased industries. SUSTAINEXT will scale-up and validate an industrial facility to produce botanical extracts, based on three key pillars. First, the whole valorization of bio-based feedstocks with a zero-waste and zero-emissions ambition. SUSTAINEXT will be deployed with six feedstocks. Three medicinal and aromatic plants (Rosemary, Chamomile, and Lemon verbena) will be locally sourced from disused tobacco fields with installed agri-voltaics; and three underexploited agro-industrial side streams will be further valorized (Olive, artichoke-cardoon, and pomegranate). Second, a dynamic, analytical biorefinery (DYANA) will isolate polyphenol and tri-terpenes from feedstocks in a disruptive and circular way. SUSTAINEXT explores 12 valorization routes (VRs) to extract and purify 46 functional ingredients, of which 13 are new in the market and 12 are newly produced in Europe. Third, the integrated and versatile value chain engages all actors, from feedstocks suppliers to extract users in the industries of food, animal feed, nutraceuticals, cosmetics, chemical performance, soil enhancers and fertilizers. This paper addresses SUSTAINEXT activities towards zero impacts and full regulatory compliance. A comprehensive Life Cycle Thinking approach is proposed, with four complementary assessments running iteratively along the project duration (4,5 years). These are the Life Cycle Cost (LCCA), Life Cycle (LCA), Social Life Cycle (S-LCA) and Circularity (CA) assessments. The LCA will help evaluate the feedstock suitability parameters and intrinsic characteristics that quantify the feedstock's grade for a determined use, and the feedstock's suitability index for a specific VR. The LCA will also study the emissions, land use change, energy generation and consumption, and other environmental aspects and impacts of the VRs, to identify the most resource efficient and less impactful distribution of products from the circular biorefinery model used in SUSTAINEXT. Challenges to complete the LCA include the definition of the system boundaries, carrying out a robust inventory, and the proper allocation of impacts to the different VRs.

Keywords : biorefinery, botanical extracts, life cycle assessment, valorization routes.

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