

## Advanced Biotechnologies and Biorefinery Aspects Towards Circular Economy and Carbon Neutrality

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### ABSTRACT

Bio-based technologies and biorefinery processes are highlighted as carbon neutral processes due to their greener and environmentally friendly nature. In this context, lignocellulosic agricultural waste generation from various cultivation and manufacturing industries in Stavanger, Norway is utilized for various products and fuel production. Various feedstocks, such as, Cucumber stem/stalk waste, Tomato stem/stalk waste from a local farming facility, spent coffee grounds sourced from UiS campus, Spent brewers' grain as a side product of the beer making process sourced from a local brewery (Lervig Brewery) have been utilized for the bioproducts and energy generation. TEA (Techno/Economic analysis) was proposed and evaluated for various schemes and processes. New approaches practiced in some local companies are highlighted towards cost-effective and sustainable practices of food-waste treatment and aqua feed generation. This study evaluates the techno-economic viability of a multi-feedstock biorefinery designed to valorize various Norwegian lignocellulosic waste streams into multiple value-added products, operating over a 20-year lifetime and 345 days per year. Six process configurations, representing three scenario designs, each assessed at two production scales (25 and 250 kt/year), were analyzed. Besides, Scale-up of such biorefinery towards greener and carbon neutral aspects were discussed.

**Keywords:** carbon neutrality, bioeconomy, spent coffee grounds, lignocellulose

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