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**Novel integrated mechanical biological chemical treatment (MBCT) systems for  
the production of levulinic acid from fraction of municipal solid waste: A  
comprehensive techno-economic analysis**

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**Abstract:**

This paper, for the first time, reports integrated conceptual MBCT/biorefinery systems for unlocking the value of organics in municipal solid waste (MSW) through the production of levulinic acid (LA by 5wt%) that increases the economic margin by 110-150%. After mechanical separation recovering recyclables, metals (iron, aluminium, copper) and refuse derived fuel (RDF), lignocelluloses from remaining MSW are extracted by supercritical-water for chemical valorisation, comprising hydrolysis in 2wt% dilute H<sub>2</sub>SO<sub>4</sub> catalyst producing LA, furfural, formic acid (FA), via C<sub>5</sub>/C<sub>6</sub> sugar extraction, in plug flow (210–230°C, 25bar, 12s) and continuous stirred tank (195–215°C, 14bar, 20mins) reactors; char separation and LA extraction/purification by methyl isobutyl ketone solvent; acid/solvent and by-product recovery. The by-product and pulping effluents are anaerobically digested into biogas and fertiliser. Produced biogas(6.4MWh/t), RDF(5.4MWh/t), char(4.5MWh/t) are combusted, heat recovered into steam generation in boiler (efficiency:80%); on-site heat/steam demand is met; balance of steam is expanded into electricity in steam turbines (efficiency:35%).

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