19th World Congress on
Biofuels and Bioenergy

November 13-14, 2025

Webinar

Waste-to-energy conversion: Catalytic upgrading of municipal solid waste into green bio-oils

Sofia Martinez
Complutense University of Madrid, Spain

Municipal solid waste (MSW) represents an abundant feedstock for renewable energy production, offering simultaneous benefits in waste reduction and fuel generation. This study investigates catalytic pyrolysis using modified zeolite-based catalysts to convert MSW into high-quality bio-oils suitable for transportation fuels. Feedstock was pre-sorted and thermally pretreated to enhance conversion efficiency. Catalysts doped with nickel and cerium improved deoxygenation and aromatic stabilization, yielding bio-oils with significantly reduced acidity and enhanced calorific value. The optimized process produced a 48% liquid bio-oil yield, with 80% of hydrocarbon chains suitable for refinery upgrading. Gas-phase products were captured for heat recovery, improving total energy efficiency. Environmental analysis indicated reduced carbon emissions alongside lower landfill dependency. The results demonstrate that catalytic waste-to-energy pathways can contribute substantially to urban sustainability initiatives.

Biography

Sofia Martínez is a chemical engineer and researcher at the Complutense University of Madrid specializing in waste-to-energy technologies, catalytic upgrading, and circular bioeconomy systems. She has collaborated with European waste management agencies and published widely on sustainable fuel synthesis. Her work focuses on bridging industrial chemistry with environmental engineering to create scalable renewable energy solutions.

Received: 15 July, 2025; **Accepted**: 19 July, 2025; **Published**: 15 December, 2025