

ABSTRACT

Diesel fuel, derived from crude oil, significantly contributes to greenhouse gas emissions and global warming, emphasizing the critical need for sustainable energy sources. Furthermore, waste accumulation represents one of the most pressing environmental challenges facing contemporary society. This research project aimed to address the issue of waste accumulation while simultaneously generating a renewable and sustainable energy source. The research focuses on converting animal waste into sustainable fuel production using a green catalyst derived from waste. Converting animal waste into sustainable fuel production is an innovative approach to address both waste management and renewable energy challenges. A novel solid catalyst modified using an impregnation method to create a bifunctional catalyst. The effectiveness of these catalysts in biofuel production was assessed against traditional homogenous base catalysts, yielding 90.4%, 88.7%, 81%, and 58% for novel catalyst, CaO, MgO-CaO, and KOH, respectively. The novel catalyst showed the highest efficiency, followed by CaO. Stability tests indicated a yield drop for novel catalyst from 90.4% to 80.87% after third cycle. A parametric study identified optimal conditions for biodiesel synthesis: 2 g catalyst loading, a 1:12 oil-to-methanol molar ratio, and a reaction time of 3 hours. Methyl esters were confirmed using FTIR and GC-MS, identifying compounds like 9-Octadecadienoic acid (z)-methyl ester. Catalyst characterization via SEM and XRD showed distinct morphologies and elemental compositions, with XRD revealing peaks for CaO. SEM images displayed a mix of shapes, particularly in the novel catalyst.

Keywords: Deasil fuel, Greenhouse gases, bifunctional catalyst