# Biodiesel Production via Microwave-Assisted Transesterification of Waste Canola Cooking Oil Using Mixed CaO, MgO, and $Al_2O_3$ as Heterogeneous Catalyst

Patricia Anne B. Bantolo[1], Ann Mojica M. Magallanes[1], Jakov M. Mercado[1], Justin Frave V. Samaniego[1], Arturo Tapas Jr.[1], Jayson De Torres Binay[1], Rugi Vicente C. Rubi[1]

[1]Chemical Engineering Department, College of Engineering, Adamson University, 900 San Marcelino St. Ermita, 1400, Manila, Philippines

## Abstract

Recently, the increased in the demand of non-fossil-based fuel for energy consumption prompted researchers to look for ways to enhance transesterification yield. One particular technique is to speed up the biodiesel conversion with green technology incorporation like microwave-assisted operation and mixed heterogeneous catalyst. In this study, a novel approach of exploiting the synergy of microwave and mixed catalysts of Calcium Oxide (CaO), Magnesium Oxide (MgO), and Aluminum Oxide ($Al_2O_3$) was employed in the transesterification of waste cooking oil. The transesterification process was conducted with varying oil-methanol ratio and CaO-MgO-$Al_2O_3$ mixed catalyst of 0.5, 1.2, 1.95, 3.0, and 3.75 wt%. Results showed that the highest biodiesel yield of 36.24% was obtained at 1:6 oil-methanol ratio with 1.95 wt% of mixed catalyst. The physico-chemical properties of the biodiesel produced like density of 0.9155-1.0558 kg/L, kinematic viscosity of 19.960 -23.041 $mm^2/s$ and lower flash point of 35.6 – 39.0 $^oC$. The GC-MS analysis results showed the prominent presence of 9-octadecenoic acid associated with the formation of fatty acid methyl esters. The study presented the potential of the proposed method in obtaining biodiesel fuel in a fast and sustainable way that could reduce reliance on non-renewable fossil fuels. Finally, the viability of using the mixed catalysts of CaO, MgO, and $Al_2O_3$ in a microwave-assisted transesterification process using waste cooking oil has been presented.

***Keywords:*** *Biodiesel, waste oil, heterogeneous catalyst, microwave-assisted transesterification, FAME*