

## Biodiesel Production Using Eggshells as a Catalyst

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**Abstract :** Increasing environmental pollution is caused by various factors, including the usage of vehicles. Legislation is focused on the increased usage of renewable energy sources for fuel production. Electric car usage is also important; however, it is relatively new and expensive transport. It is necessary to increase the amount of renewable energy in the production of diesel fuel, whereas many agricultural machineries are powered by diesel, as are water vehicles. For this reason, research on biodiesel production is relevant. The majority of studies globally are related to the improvement of conventional biofuel production technologies by applying the transesterification process of oil using alcohol and catalyst. Some of the more recent methods to produce biodiesel are based on heterogeneous catalysis, which has the advantage of easy separation of catalyst from the final product. It is known that a large amount of eggshells is treated as waste; therefore, it is eliminated in landfills without any or with minimal pre-treatment. CaO, which is known as a good catalyst for biodiesel synthesis, is a key component of eggshells. In the present work, we evaluated the catalytic efficiency of eggshells and determined the optimal transesterification conditions to obtain biodiesel that meets the standards. Content CaO in eggshells was investigated. Response surface methodology was used to determine the optimal reaction conditions. Three independent variables were investigated: the molar ratio of alcohol to oil, the amount of the catalyst, and the duration of the reaction. It was obtained that the optimum transesterification conditions when the methanol and eggshells as a heterogeneous catalyst are used and the process temperature is 64°C are the following: the alcohol-to-oil molar ratio 10.93:1, the reaction duration 9.48 h, and the catalyst amount 6.80 wt%. Under these conditions, 97.79 wt% of the ester yield was obtained.

**Keywords :** heterogeneous catalysis, eggshells, biodiesel, oil

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