

Seminar Title	: Biodiesel production via homogeneous and heterogeneous transesterification from different biomass sources
Speaker	: Surya Pattnaik (Rollno : 521ch1003)
Supervisor	: Prof. Pradip Chowdhury
Venue	: New Seminar Room (Department of Chemical Engineering)
Date and Time	: 22 Jul 2024 (04:15 PM)
Abstract	<p>: Homogeneous transesterification for producing biodiesel is a well-known method. Blending of raw oils has found its way as an effective feedstock lately. Heterogeneous catalysts have some distinct advantages over homogeneous types. Ease in separation post synthesis, regenerability, requirement of mild operating conditions are a few of them. The primary sources for deriving heterogeneous catalysts from biomass have been leaves, shells, branches, stems, seeds, etc. Flowers/flower petals have not been thoroughly investigated as a source. Biochar as a catalyst have been gaining wide acceptability in transesterification reactions, however, most of the biochar used are either supported or chemically modified for enhancing the properties and performance. Conversely, suitability of ' prepared from biomass is relatively less studied as a catalyst in biodiesel synthesis. In this study, Sunflower, Mustard, Coconut, Castor, and Sesame oils were primarily used as a source material in biodiesel synthesis via homogeneous transesterification to evaluate their suitability under the working conditions. Different blends of vegetable oils were also tested. Pure sesame oil, and blend of sunflower and mustard oils yielded best biodiesel product. In heterogeneous method, <i>Mussaenda Phillipica</i> (MP) was chosen as a source for synthesizing catalyst, primarily in ash form. MP flowers were collected, air-dried, and then treated in muffle furnace at 400°C for 2 h to produce <i>Mussaenda Phillipica</i> Ash (MPA). Morphological analysis was performed using SEM which confirmed MPA to be mesoporous and spongy in structure. EDX result established presence of K as the primary element along with Ca, Mg, S, P, and O. XRD peaks at 25.5, 28.6, 33.4, 39.5, 40.9 confirmed presence of K₂O and K₂CO₃. Auxiliary peaks at 31.6, 36.1° was for CaO and CaCO₃ respectively while peak at 29.6° belonged to SiO₂. FT-IR peak at 1385 cm⁻¹ was linked with the main group K₂CO₃. Furthermore, peaks at 1036 cm⁻¹ and 681 cm⁻¹ resembles the stretching band of Si-O-Si and peak position at 861 cm⁻¹ was linked with isolated SiO₄. The main component present in the MPA is K and its oxides and carbonates which makes the catalyst to be basic in nature. Hence, MPA is a heterogeneous base catalyst and the reaction is said to be heterogeneous basic catalyst transesterification. BET analysis was carried out to calculate the surface area of the catalyst which was found to be 11.120 m²/g. Pore volume and pore diameter were 0.0389 cc/g and 14.013 nm respectively. Heterogeneous transesterification was performed as per the following details: Sesame oil (30 g), MPA loading 6 wt.%, time=6 hours, temperature=65°C with a stirring speed of 400-500 rpm. The product was neutralised several times and kept under drying to get the desired fatty acid methyl ester (FAME). Physico-chemical properties were evaluated using standard methods and apparatus and the results were promising (ASTM standards). The Cetane number of SO BD (H) was 69.108 and GCV of the biodiesel was measured ca. 59.59 MJ/kg. FT-IR analysis of the synthesized product showed the finger-print peaks at 1196 cm⁻¹ and 1016 cm⁻¹ respectively which can be attributed to the presence of methyl ester group. NMR spectroscopy of the FAME confirmed successful conversion of triglycerides to methyl ester with symptomatic peaks at 3.68 ppm (¹H NMR) and 51.38 ppm (¹³C NMR) respectively. The conversion and yield of the biodiesel were 90.15% and 80.65% respectively.</p>