Final Year Project Showcase Batch-2021
For the Year 2025

Department of Chemical Engineering Name of Programme: Chemical Engineering		
1	**Project Idea**	Biofuel Production by Co-Pyrolysis of Waste Oils and Mixed Plastic Waste: Study of Composition
2	**Process**	The project aims to produce sustainable biofuel by thermally decomposing a mixture of waste lubricating oil (WLO), waste cooking oil (WCO), and mixed plastic waste (MPW) through non-catalytic co-pyrolysis. The key idea is to optimize the feed ratio and process conditions to maximize fuel yield and quality while solving urban waste disposal issues.
3	**Outcome**	• Achieved maximum oil yield of 87 wt.% from a WLO-rich sample (2:1:1). • Plastic-rich samples (1:1:2) showed superior diesel-like properties (~72% diesel-range hydrocarbons). • Demonstrated the viability of turning urban waste into clean fuel, contributing to circular economy goals.
4	**Evidence (Theoretical Basis)**	Every year, billions of tons of waste oils and waste plastics are discarded, posing severe environmental hazards and contributing to resource depletion. To address this, our research focuses on converting Waste Lubricating Oil (WLO), Waste Cooking Oil (WCO), and Mixed Plastic Waste (MPW) into alternative fuels through non catalytic co-pyrolysis. The feedstocks undergo thermal decomposition under oxygen-free conditions, producing liquid fuels that can potentially substitute conventional fuels. The research was conducted in several stages, starting with calibration experiments to optimize the operating conditions for co-pyrolysis. These experiments were performed at varying temperatures and residence times, under 1 atmospheric pressure, oxygen free environment and a feedstock composition of WLO, WCO, and MPW in equal ratios. LDPE and HDPE were tested separately with the oils to determine decomposition temperatures. No catalyst was used in these initial tests, and the yields of co-pyrolytic products were carefully measured. The optimal conditions identified were in the range of 400-450°C and 5-10-minute residence time, which ensured efficient thermal degradation of the feedstock. Co-pyrolysis experiments were then carried out at four different ratios of WLO, WCO and MPW i.e., (1:1:1), (1:2:1), (2:1:1) and (1:1:2) to obtain four samples of co-pyrolytic oil. The experiments were repeated in order to minimize the yield error. These experiments were followed by a series of ASTM D86 Distillation to determine the product distribution of each of these samples. And finally, property testing according to the ASTM standards were carried out for these samples to determine sulfur content, kinematic viscosity, API gravity, Cetane index, pour point and flash point in order to assess the viability of the resulting co-pyrolytic oil for use as an alternative fuel.

5	**Competitive Advantage or Unique Selling Proposition** (Cost Reduction, Process improvement, Attainment of any SDG (Sustainable Development Goal), increase of market share or capturing new market or having superior performance over a competitor. In summary, any striking aspect of the project that compels the industry to invest in FYP or purchase it. Some detailed description is required in terms of how, why when what. You can select one or more from the following dropdown and delete the rest of them) Please keep relevant options, delete the rest of them, and correct the sequence	
a	**Attainment of any SDG** (e.g. How it is achieved and why it is necessary for the region)	SDG-7 (Affordable & Clean Energy): The innovative use of co-pyrolysis in the production process minimizes environmental impact while offering a cost-effective alternative to traditional fossil fuels. SDG-12 (Responsible Consumption and Production): By extending the lifecycle of waste materials and promoting waste-to-resource transformation, the project aligns with global efforts to achieve sustainable production systems and minimize waste generation.
b	**Capture new market (**e.g. Niche market or unaddressed segment**)**	Targets sustainable fuel markets, municipal waste management authorities, and eco-friendly energy producers, offering a scalable solution for urban regions.
c	**Any Environmental Aspect** (e.g. carbon reduction, energy-efficient, etc.)	Reduces greenhouse gas emissions and minimizes harmful waste incineration. Also, mitigates the dependence on fossil derived fuels.
6	**Target Market** (Industries, Groups, Individuals, Families, Students, etc) Please provide some detail about the end-user of the product, process, or service	• Petroleum refining industry • Biofuel companies • Urban waste management departments • Local governments and municipalities • Environmental NGOs • Research institutions and energy labs • Power generation units seeking alternative fuels
7	**Team Members (Names & Roll No.)**	Maaz Akbar Jatoi – maazjatoi1@gmail.com Wareesha Sajid – wareesha.sajid@gmail.com Talha – talhakhalid73@gmail.com Hafsa Jamshaid Alam – hafsaj398@gmail.com
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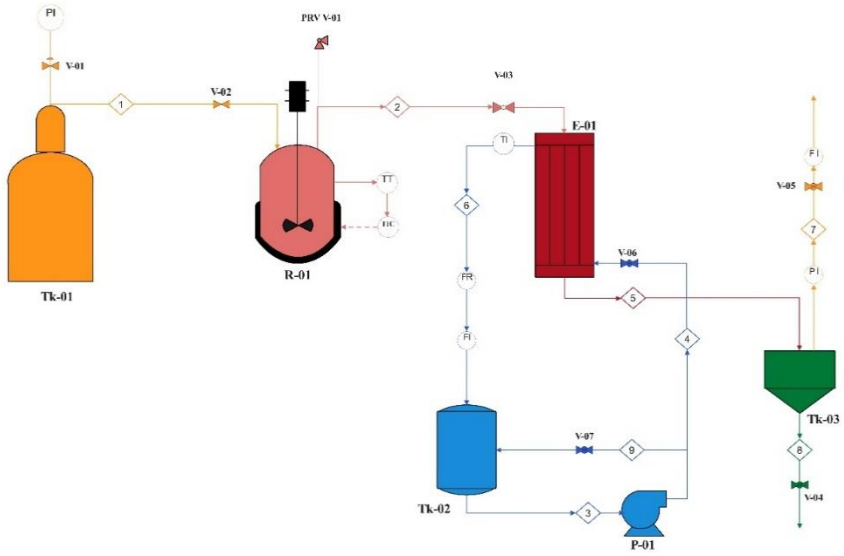
10	**P&ID**	
11	**Video (If any)**	**Nil**