Multi Objective Optimization (MOOP)of biodiesel production from waste cooking oil via Response Surface Methodology (RSM)

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In order to achieve the optimal conditions of Multi Objective Optimization (MOOP) of the procedure of using waste cooking oil to produce biodiesel, Response Surface Methodology (RSM) based on a Central Composite Design (CCD) was utilized. There are two functions of the MOOP, which are minimizing the total capital cost (f1) and minimizing the cost of operations (f2). This research study included an experiment that was conducted using the CCD in order to determine the conditions that provide optimization of the procedure for producing biodiesel. The choice of CCD to improve the thirteen parameters was due to it being one of the most widely-used programs in RSM that is commonly know to provide the most effective results. The production of this experimental set using CCD was conducted to examine the effects of the independent parameters on the mass fraction of FAME, % FAME purity, the mass fraction of Glycerol, and % Glycerol purity. Additional research on the optimization by CCD showed the total capital cost to be USD 8,364,795 and the cost of operations as USD 1,732,590 per year. In comparison with the original procedure, it was found that there is a cost savings that can reach USD 1,185 and USD 6,870 per year, respectively. Therefore, the findings of this research from the MOOP based on RSM of the process for producing biodiesel from used cooking oil were satisfactory. In conclusion, it can be summarized that this method of optimizing the procedure will provide an effective basis for the achievement of future production of biodiesel that is stable and reliable.

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