**Title:**

***‘Multi-objective RSM-based optimization of Diesel-Diethyl ether (D-DDE) blends for Eco-friendly CI Engines and SDG’s achievement***.’

**Abstract:**

With the plummeting reserves of fossil fuels at present, there has been a growing imperative for the sustainable energy technologies over the last couple of decades. This imperative highlights the need for a shift towards renewable sources, not just to fulfill the current energy demands but also to lessen the environmental degradation, thus fostering an eco-conscious and sustainable future. One way to accomplish such a goal is the utilization of diesel-diethyl ether(D-DEE) blends, instead of neat diesel in compression ignition (CI) engines. This study employed the multi-objective RSM based analysis and optimization of D-DEE blends (0,5 and 10 SCFH) at manifold engine speeds (1200, 1400 and 1600 rpm). The responses that were recorded in this research included brake power (B.P), brake thermal efficiency (BTE), brake specific fuel consumption and CO2 emissions. The results demonstrated an increment in brake power as well as brake thermal efficiency, along with the enhanced CO2 emissions whereas the BSFC decreased while using the Di-ethyl ether enrichment in a 4-stroke CI engine. Upon implementing optimization parameters, the results illustrated the optimal blend ratio of 9.1 SCFH at 1587 rpm, along with the associated values of B.P, BTE, BSFC and CO2 emissions which were, 1.265 kw, 21.6%, 0.364 and 6.58% vol, respectively for this optimized fuel. This research aligns with the attainment of several sustainable development goals (SDG’s) which include calling for affordable and clean energy (SDG 7), availability of responsible consumption (SDG 12) and taking climate actions (SDG 13), contributing towards greener and cleaner future.

**Keywords:** Response Surface Methodology, Optimization, Di-ethyl ether, Sustainability, SDG, Renewable Alternate Fuel