

ABSTRACT

There is an urgent interest initiated to develop clean energy resources with the aim of reducing exposure to environmental pollutants and explore model fuels that can hasten the achievement of clean energy combustion. This work investigates various ratios of biodiesel and commercial diesel in order to propose model binary fuels for clean energy combustion. Accordingly, diesel blends of ratios 1:1, 3:2 and 2:3 were each pyrolyzed at a contact time of 5 s in a quartz reactor at 1 atmosphere pressure. A model temperature of 500 °C was explored in these experiments. The charcoal content for pure fossil diesel was compared with the binary diesel residue. Gas-phase molecular components were determined using Gas chromatography (GC) coupled to a mass selective detector (MSD). Elemental composition of thermal char was determined using Smart Elemental Analyzer. Radical intensities for the three types of char (biochar, bio-fossil char, and fossil char) were measured using an X-band electron paramagnetic resonance spectrometer. It was noted that at a ratio of 2:3 (Biodiesel: Fossil diesel), harmful molecular products reduced significantly, 76–99%. Elemental analysis data indicated that the carbon content from commercial diesel was very high ($\approx 70.61\%$) as compared to approximately 53% for biodiesel-fossil diesel mixture in the same ratio 2:3. Interestingly, the free radical content was reduced by nearly 50% in favour of the biodiesel/fossil diesel mixture. These results are encouraging and suggest that a better optimized fuel mixture has been found for better clean energy combustion.