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# Effect of Antioxidants Extracted from Clove Wastes and Babul Tree Barks on the Oxidation Stability of Biodiesel made from Water Hyacinth of Lake Victoria Origin

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## Abstract

Biodiesel from water hyacinth has shown to have poor oxidative stability due to the presence of significant amounts of unsaturated fatty acids. Most studies have been using synthetic antioxidants to improve oxidation stability of biodiesel but they are expensive and proved to be toxic at higher concentrations. This study assessed the possibility of using natural antioxidants extracted from clove wastes and babul tree barks since they are cheap, easy to extract and locally available and blends of these with synthetic antioxidant such as 1,2,3-trihydroxybenzene (Pyrogallol, PY) in improving the oxidation stability of biodiesel. Non-edible water hyacinth collected from Lake Victoria Tanzania was used as feedstock for biodiesel production. The biodiesel was analyzed for physicochemical properties and fatty acid composition. Most of the physicochemical properties were within the acceptable limits for ASTM D6751 and EN 14214 except for oxidation stability which recorded 2.4 h and was below limits. Fatty acid analysis showed the presence of unsaturated fatty acids at 42% which contributed to the poor oxidation stability of the biodiesel. Clove waste and babul barks displayed significant total phenolic contents of  $220.0 \pm 0.1$  and  $48.0 \pm 0.2$  mg GAE/g, respectively. Clove antioxidant displayed an improvement of 153% in oxidation stability at 1000 ppm while babul improved by 236% at 800 ppm. Blends of clove with PY displayed much higher improvements in oxidation stability by 398% at 800 ppm while babul with pyrogallol showed a general decrease in performance by 46%.

## Keywords

**Biodiesel, Oxidation stability, Antioxidants, Clove and babul barks**