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Production of biolubricant from renewable feedstocks from Qatar

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Due to increase in environmental pollution and decline in petroleum reserves, there is an increase in the demands of developing alternative renewable bio-based products. Petroleum and lubricant manufacturing companies are searching for alternative renewable bio-based products since environmental protecting agencies, all over the world, are putting stringent environmental regulation in practice. Especially, there is a lot of ongoing research to find an alternative and renewable fuels and lubricants. One such alternative for mineral oil based lubricants are biolubricants as they have minimal impact on the environment and human health; furthermore, they have lesser toxicity, excellent lubricating properties, and a higher biodegradability index. Recent research is primarily focused on the synthesis of biolubricants from vegetable oils or animal fats either by chemically modifying the structure of oil or by blending of additives. The aim of this study was to develop biolubricants from renewable feedstocks, found in Qatar, by blending a viscosity modifier additive to meet the existing lubricant standard specifications. We selected 3 renewable feedstocks from Qatar: (i) Waste cooking oil, (ii) Jojoba seeds, and (iii) Waste date seeds. Unlike waste cooking oil and date seeds, jojoba oilseeds need to be collected from the plant. Jojoba plants can be irrigated with brackish water and can be grown in arid region. Oil-rich jojoba seed, therefore, can be considered as the base oil for biolubricants. Waste cooking oil was procured from a local restaurant in Doha, Qatar. Both the Jojoba seeds and the waste date seeds were collected from the Qatar University Biology farm in Zubarah. Initially, the seeds were sun-dried and grounded using a kitchen grinder. Next, oil from jojoba seeds and waste date seeds was extracted using a soxhlet extractor; hexane was used as extraction solvent. Soxhlet extractor was operated for 8 hrs to extract oil from jojoba seeds and waste date seeds. Oil yields from jojoba seeds

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and waste date seeds were found to be 55% and 10.2% (wt/wt basis) respectively. Waste cooking oil (WCO), jojoba oil (JO) and waste date seed oil (WDSO) were further blended with a viscosity modifier additive, i.e., ethylene vinyl acetate (EVA) in concentrations of 2%, 3% and 4% to formulate biolubricants from all three vegetable oil feedstocks. Addition of viscosity modifier-Ethylene vinyl acetate to WCO, jojoba oil and waste date seed oil increased the kinematic viscosities to maximum values for WCO from 70 mm2/s to 197 mm2/s at 30°C; similarly for jojoba oil it increased 27 mm2/s to 154 mm2/s at 30°C for Waste date seed oil it increased from 29 mm2/s to 160 mm2/s at 30°C. Viscosity for commercial oil (Mobil 20W40 Engine oil) was 190 mm2/s at 30°C. Viscosity index for all biolubricant formulations was calculated and it was found to be above 180. Thermogravimetric analysis of biolubricants revealed that formulated biolubricants were thermally more stable in order of WCO>DSO>JO>CO (Commercial oil). Biodegradability index was calculated BOD/COD ratio it was found to greater than 0.5. In this study, we found that biolubricants formulated from waste cooking oil, jojoba oil, waste date seed oil using viscosity modifier additive and all these biolubricants exhibited increased viscosity, higher viscosity index, better thermal stability and high biodegradability when compared with conventional mineral oil-based lubricant.