A review of renewable and sustainable resources from palm based oil

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**ABSTRACT**
Sustainability are an important subject in most research recently to encounter the depletion of mineral resources globally. This paper are reviewing the potential of local resources of palm oil as a renewable resources where several efforts and research has been done to develop and utilizing the palm oil to a new field.

1. **Introduction**

Asian region are known as the largest producers of palm oil with Malaysia contributes as a seconds largest country of palm oil producers in and the most palm oil exporters in 2011. Palm oil majorly been used in the food industry such as cooking oil and shortening while some are manufacturing the palm oil as a margarine and soap.

The production of palm oil produces several palm oil products such as palm olein, palm kernel oil, palm fatty acid distillate, palm stearin and many other products. The usage of several palm oil products such as RBD palm kernel oil, RBD Palm stearin and Palm fatty acid distillate are few and has a potential to be develop into others field application.

This paper are reviewing a research study that has been done to identify several palm oil products to be used as a lubricants.

2. **Palm oil products**

Most of the study to develop a renewable resources are focusing on various vegetables oil resources [1], [2] and palm oil products are one of the option used. Palm oil products are processed from a fresh fruit bunch where main products produced was a crude palm oil and palm kernel. Palm kernel undergo a refining process to remove the color, odor and flavor and produces the RBD Palm kernel oil. RBD palm stearin was produced from the refining and fractionation process of crude palm oil while palm fatty acid distillate produces from the process of refining and distillation of crude palm oil. The process was illustrates in Figure 1.

RBD palm stearin used as pastry fat, margarines and soap manufacture. Palm fatty acid distillate used as animal feed and detergents while RBD palm kernel oil used as a confectionery, ice cream and soap formulas. This products has a few application and are existed in a semi solid state with melting point above room temperature.

![Figure 1: Illustration of several palm oil productions](image-url)

3. **Experimental research on palm oil as lubricants**

Several research has been done to investigate the potential of palm based oil as lubricants. This efforts is to take the advantage of palm oil as a renewable resources. Palm olein highly been used as a cooking oil and are not recommended to be used as lubricants to avoid market demand conflict. Therefore, the most palm based oil used in the research was RBD palm kernel oil, RBD palm stearin and palm fatty acid distillate.

In the earlier stage, palm oil has been study as a potential lubricant oil where the benefit of having long fatty acid chain which believe can

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reduces friction and improve wear. A comparison study on tribological behavior between RBD Palm Olein and Paraffinic Mineral Oil using fourball tribotester machine [3] found that the coefficient of friction of RBD Palm Olein is better than Paraffinic Mineral Oil, however result gain for wear scar is vice versa [4]. The finding is consistent with the findings of RBD Palm Stearin by Ing et al. [5] and Syahrullail et al. [6] which analyze the coefficient of friction value and found that RBD palm stearin demonstrated better lubricant properties at lower temperature. Nevertheless, paraffinic mineral oil only showed better performance at high temperature. This is attributed to the instability of lubricant film formed by fatty acid molecule. Variation of carotene content in the palm oil based lubricant effecting the shear strength where this lead to a decreases of shear strength and viscosity when temperature increases. Musa [7] also implied bleached palm oil demonstrated better lubricating features than palm oil. RBD Palm Stearin is a by-product produced by fractionation process of RBD Palm Olein where it is rich with saturated fatty acids, which makes them as a solid phase at ambient temperature. Evaluation of friction and wear characteristic using three different lubricants palm base-oil, which are RBD Palm Olein, additive-free paraffinic mineral oil and commercial hydraulic oil were investigate by Izhani et al. [8]. The researcher simulated the process of wear in a controlled manner and studied the effect on different samples with the same test conditions by performing pin-on-disk tests. The study by Maleque et al. [9] examine the wear and friction of hardened AISI 1045 steel correlation with the rate of Palm Oil Diesel (POD) quantity needed to endured and enhance the anti-wear qualities. Golshokouh et al. [10] compare the performance of palm fatty acid distillate with petrochemical based lubricant at various speed while Syahrullail et al. [11] has blended Palm Fatty Acid Distillate with Commercial Engine Oil to evaluate the tribological performance. The blending ratio was ranging from 5% to 25% of commercial mineral oil and the results shows that 20% blended ratio yield lowest coefficient of friction.

4. Future research recommendation

Most study on tribological performance of palm based oil products has been done without any additional process especially to improve the usage of palm oil performance at lower temperature. In the future, extra effort on modification can be done to the palm based oil which has a few application and highly potential as lubricant such as RBD palm kernel oil, RBD palm stearin and palm fatty acid distillate. This includes in the chemical reaction modification, additives modifier and performance improver. Wu et al. [12] has added a nanoparticle into the oil and found that coefficient of friction has slightly been reduced. Also Zuan and Syahrullail [13] through a transesterification modification of RBD palm kernel oil found that the coefficient of friction and wear scar performance are better than commercial semi synthetic oil. Hopefully there are more efforts will be imply to the usage of palm oil globally and help to increase the usage of renewable and sustainable resources.

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Reference


