

CHAPTER V

CONCLUSION

The goal of this research was to synthesize diesters as potential lubricating base oil from palm oil and its free fatty acids, i.e., oleic acid, stearic acid and palmitic acid, with various diols, i.e., 1,3-propanediol, 1,4-butanediol, 1,5-pentanediol, 2,2-dimethyl-1,3-propanediol and 2-ethyl-1,3-hexanediol, using concentrated sulfuric acid as a catalyst.

Two reaction methods were studied. The first consisted of two distinct processes ; transesterification and re-transesterification of palm oil. The second was esterification of the fatty acids of palm oil.

From this study, it could be concluded that diester products from palm oil and its free fatty acid consisted of liquid and solid. The physical properties of solid products could not be determined (e.g. kinematic viscosity and pour point). These are unsuitable for use as automotive lubricating base oils. The liquid products were found to be suitable for use as lubricating base oils, because of good physical and chemical properties, especially products from 2-ethyl-1,3-hexanediol.

The optimum conditions for the reaction of 2-ethyl-1,3-hexanediol with palm oil, oleic acid, stearic acid and palmitic acid are summarized in Table 5.1. The physical and chemical properties of the diester products from Table 5.1 are summarized in Table 5.2.

Table 5.1 : The optimum conditions for synthesis of 2-ethyl-1,3-hexanediester products

Raw material	Reaction temperature (°C)	Reaction time (hr)	yield (%)
palm oil	80	3	88.72
oleic acid	130	3	86.78
stearic acid	130	3	92.55
palmitic acid	130	3	91.18

Table 5.2 : Comparison of the physical and chemical properties of lubricating base oil (150SN) and 2-ethyl-1,3-hexanediester products

Properties	150SN	Diester1	Diester2	Diester3	Diester4
Color, ASTM	0.5	1.5	2.0	1.0	1.0
Kinematic Viscosity					
@ 40 °C	30.54	22.65	21.52	24.40	23.46
@ 100 °C	5.25	5.24	5.15	5.45	5.25
Viscosity Index	103.85	170.83	182.62	169.61	165.29
Pour Point, °C	-9	-9	-15	+9	-3
Flash Point, °C	224	208	212	182	206
Oxidation Point, °C	313.2	488	488	470	463
Oxidation Compounds,%wt	17.61	2.01	2.50	2.17	1.54

Diester1 : 2-ethyl-1,3-hexanediester product from palm oil

Diester2 : 2-ethyl-1,3-hexanediolate

Diester3 : 2-ethyl-1,3-hexanedistearate

Diester4 : 2-ethyl-1,3-hexanedipalmitate

The results from Table 5.2, indicate that each product from 2-ethyl-1,3-hexanediol with palm oil and its free fatty acid are suitable for use as automotive lubricating base oils, because they meet specifications.

Suggestion for Future Work

Synthetic diester lubricating base oils from natural fat and oil which having long chain fatty acid should be improved structure of natural fat and oil before synthesizing them, since long chain fatty acid in natural fat and oil may be achieved unsuitable synthetic diester lubricating base oils for automotive lubricants. Improving structure of natural fat and oil possess several process, e.g. ozonolysis and cracking.



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