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A green technology approach for the innovative production of grease

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ABSTRACT

As we know that the availability of crude oil will be decreasing day by day, thus the production of lubricants like grease will be stopped normally. So this method of production of grease is an alternative. *Madhuca longifolia* is an Indian tropical tree found largely in the central and north Indian plains and forests. The oil contains about 60% of fatty acid content so it much favorable for the saponification reaction. This method of production is economical when compared to the conventional methods. The obtained product is eco-friendly because it is easily degradable. The viscosity test and sample preparation on grease was visualized in this research, where the viscosity of grease was decrease with the increasing of spindle speed and the viscosity was increase with the increasing of percentage soap (thickener) added. The best way to produce grease is with lithium soap, where sodium soap is the strongest thickener compare to another thickener.

KEY WORDS: eco-friendly, lithium base, fatty acid, saponification reaction.

1. INTRODUCTION

Grease is a semi fluid to solid mixture of a fluid lubricant, a thickener and additive. The fluid lubricant that performs the actual lubrication can be petroleum (mineral) oil, synthetic oil, or vegetable oil. The thickener gives grease its characteristic consistency and holds the oil in place. Common thickeners are soaps and organic or inorganic non soap thickeners.

Soaps are the most common emulsifying agent used, and the type of soap depends on the conditions in which the grease is to be used. Different soaps provide differing levels of temperature resistance (relating to both viscosity and volatility), water resistance, and chemical reactivity. Powdered solids may also be used, such as clay, which was used to emulsify early greases and is still used in some inexpensive, low performance greases.

The majority of greases on the market are composed of mineral oil blended with a soap thickener. Additives enhance performance and protect the grease and lubricated surfaces. Grease has been described as a temperature-regulated feeding device, when the lubricant film between wearing surfaces thins, the resulting heat softens the adjacent grease, which expands and releases oil to restore film thickness.

Grease-lubricated bearings have greater frictional characteristics at the beginning of operation. Under shear, the viscosity drops to give the effect of an oil-lubricated bearing of approximately the same viscosity as the base oil used in the grease.

2. EXPERIMENTAL METHODS

2.1. Experimental setup and procedure: About 20% of the total amount of Mahua oil expected for the batch is taken in a 250ml beaker, and starts heating by using heating mantle with continuous stirring. About 1% of Hydrogenated castor oil (HCO) is added when it reaches the temperature of 75 to 80°C. Add Lithium hydroxide to it and made slurry with water slowly. The reaction will starts to activate saponification reaction, water has to be added drop wisely.

The reaction mixture will be harder after 110-120°C, Add water or oil with continuous stirring. The temperature is raised upto 150°C. The alkalinity in this stage will be 0.1 mg KOH/gm. The temperature is increased to about 180 -190°C. Once when it reaches the temperature is allowed to cool till it reaches atmospheric temperature. The Kinematic Viscosity, Viscosity index, Flash point, Pour point of the raw material is tested and the values are noted. The appropriate quality of Hydrogenated Castor oil and Lithium hydroxide are collected. The procedure is repeated for blending the lube base oil (SN 500) and the mahua oil and the results were noted. The obtained product grease is more efficient and the results were compared with the other conventional products.

2.2. Test reports of raw materials: The various composition of raw material is taken. Each type is tested for kinematic viscosity at 40 and 100°C in viscosity bath, flash point, pour point and viscosity index. The values are listed in the table 1. The viscosity at 40°C is measured in water bath and 100° C is in oil bath. All the tests are carried out as per ASTM standards.

2.3. Quantity of raw materials: The composition of thickener and HCO plays a vital role in making an efficient product. Hence the various composition depending on the amount of Mahua oil and SN 500 is calculated and tabulated in the table 2.Water is used to bond the thickener and HCO hence it is taken in appropriate amount.

2.4. Outline of overall methodology:

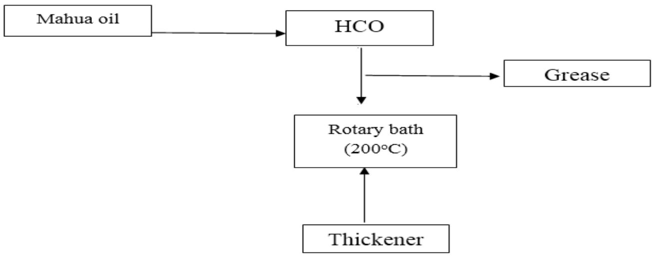

Fig.1.Block Diagram of Production Grease

Table.1.Properties of raw materials

Raw material	Kinematic Viscosity @ 40°C (cSt)	Kinematic Viscosity @ 100°C (cSt)	Viscosity index	Flash point(°C)	Pour point(°C)
100% Mahua oil	50.595	13.0855	269.22	238	-1
75% Mahua oil	68.67	20.06	160.98	238	-1
50% Mahua oil	119.56	11.06	69.03	238	-1
30% Mahua oil	144.38	12.23	65.31	238	-1
20% Mahua oil	158.50	16.02	103.6	238	-1

Table.2. Experimental conditions in the present study

Raw material	Raw materials				
	100% Mahua oil	75% Mahua oil	50% Mahua oil	30% Mahua oil	20% Mahua oil
Base oil(ml)	200	200	200	200	200
Thickener(g)	1.5	2	3	3	2
HCO(g)	21.5	21	20	20	21
Water(ml)	Required amount	Required amount	Required amount	Required amount	Required amount

3. RESULTS AND DISCUSSION

3.1. Viscosity and temperature relationship: Grease formulations are mainly due to the composition and chemico-physical properties of the base oil with particular reference to viscosity especially in relation to temperature. In the production process, the thickener of the grease was found to be increased in cooking temperature; but this could be negligible compared to the amount of thickener used. It is presented in the table 3.

Table.3.Viscosity and temperature relationship

Temperature(◦C)	Kinematic viscosity (cSt)
20	45.326
40	50.595
60	56.713
80	62.123
100	65.927

Table.4.Test reports of finished products

Raw material	Penetration test	Dropping point(°c)
100% mahua oil	185	150
75 % Mahua oil	193	157
50 % Mahua oil	207	168
30% Mahua oil	219	174
20% Mahua oil	225	178

From the table 4, penetrometer and dropping point of the various compositions grease is listed. It is clear that the obtained values are nearly equal to the market grease. Hence the performance is similar to the present products with minimum error. Hence the product obtained from this technology can be implemented to various equipment to reduce the import of base oil adding to the economic growth of the country.

4. CONCLUSION

It is evidenced from the data obtained from this research work that the aim of producing a biodegradable grease and some characteristics was met and it can be concluded that mahua oil used is a good renewable source for biodegradable grease production and the samples were successfully produced with different compositions of the base oil, thickener, additives and also under different conditions while the grease produced after being subjected to the necessary tests was far better than commercial grease used as controls. Also the fact that the dropping point of grease depends largely on the composition and consistency of stirring for the grease produced. Finally efficient and ecofriendly grease is produced with fulfilling the project objective.

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