PART III

SYNTHESIS CHARACTERIZATION AND VISCOSITY STUDIES OF BIODEGRADABLE ADDITIVES AS A POTENTIAL POUR POINT DPRESSANT AND VISCOSITY MODIFIER

CHAPTER I

1.1 A SHORT REVIEW ON BIODEGRADABLE LUBE OIL ADDITIVES

1.1.1 Introduction

Widely used engine oil additive is mainly dithiophosphate, overbased calcium sulphonate, succinimides dispersants, polymer viscosity improvers and pour point depressants. Uses of this additive create a potential environmental hazardness emission and sludge obtained during purification [1]. To counterpart this, biodegradable base stocks were developed, but reports are still scanty regarding the biodegradability of the performance additives added to the base fluids used to formulate a finished product.

The use of vegetable oils and animal fats for lubrication purposes has been practiced for many years. With the discovery of petroleum and the availability of inexpensive oils, alternatives became unattractive and were left by the wayside. Attention was refocused on vegetable oils during wartime and oil shortage situations. During World War I and World War II, the use of vegetable oils for fuel, lubricants, greases and energy transfer increased rapidly. Also, the oil embargo of 1973 brought needed attention to alternatives for petroleum oils.

However, from the past two decades, a renewed interest in vegetable oil-based lubricants as environmental interest has increased. In Europe during the 1980s, various mandates and regulations were placed on petroleum products necessitating the use of biodegradable lubricants. During the 1990s, many American companies began developing biodegradable products. A prime example is when the Mobil Corporation introduced its Environmental Awareness Lubricants (EAL) line of hydraulic fluids. The Lubrizol Corporation, USA, also developed considerable quantities of additives and sunflower oil-based lubricants. However, the lack of regulatory mandates in the United States, as well as the availability of post-Desert Storm low-cost oil, made biodegradable oils too expensive to compete.

Although but biodegradable, vegetable oils have been used as lubricants for a long time, but since the introduction of mineral oils, the later have dominated the lubricant market. Today, due to growing environmental concerns, vegetable oils are again finding their way into lubricants for industrial and transportation applications. Vegetable oils can offer significant environmental advantages with respect to resource renewability, biodegradability, as well as at the same time displaying satisfactory performance in a variety of applications [2]. They show excellent tribological properties such as friction-reducing, wear controlling, improved extreme pressure, etc. when used as additives or as base stocks or [3-5].

Vegetable –based oils are liquid agricultural products and are produced from plants. They are biodegradable non toxic and derived from foods. The source of vegetable oil is a crop and they promote self –reliance as ample production capacity exists. Vegetable oils present higher flash point than mineral oils, which always a concern with flammable liquids; they are also safer to humans.

Vegetable fats and oils (known by the generic term lipids) comprise, primarily triglycerides, that is, triesters of long chain carboxylic acids combined with glycerol. Most of these oils contain at least four and sometimes as many as 12 different fatty acids. Vegetable oils are usually good boundary lubricants but the major limitations are their high cost, thermal and oxidative instability. Oxidation stability of vegetable oils depends on the level of unsaturated products present. The lower the unsaturation the better the oxidative stability but higher the melting point. For good performance, special lubricants requirements must be fulfilled, i.e. good corrosion protection, compatibility with other materials, fair oxidative and hydrolytic stability and low temperature behaviour associated with the triglyceride.

Although the lubricant identity has been trying to formulate biodegradable lubricants under similar or even better technical characteristics than that base or mineral oils reported a very narrow segment. In recent publication Franco et al has reported the use of sunflower oil bio fuels, polymeric additives such as ethylene vinyl acetate (EVA) and styrene butadiene styrene (SBS) copolymer in lubricant formulation [6].

US pat. No 5229023 disclose the synthesis and evaluation of vegetable oil based lubricant additive which can be used as thermal oxidative stability enhancers and viscosity improvers, US pat. No. 4873008 has described the synthesis and jojoba oil based lube oil additive. US pat. No. 4970010 has described a group of sulfurised derivatives of triglyceride

vegetable oils which showed acceptable lubricating properties. Sulfurised vegetable wax esters were described in US pat. No. 4152278 to act as an anti wear, friction modifier and extreme pressure additive. Because of the cost adding conversion steps and limited availability of the above oils they did not find practical application by the additive industry. Thus they are exist and ample opportunity to work this area of vegetable oil based lube oil additives for during the environmental pollution as well as to develop lube oil additives with better performance than the conventional synthetic chemical based additive.