

STUDY ON MODIFICATION PROCESSES OF VEGETABLE OILS AND DETRIMENTAL EFFECTS OF PETROLEUM PRODUCTS

Rajani C. Chikhalonde¹, Madhura Bhalerao², Dr. V. Y. Karadbhajane³

¹Mtech student, Department of Oils, Fats and Surfactant Technology, RTM Nagpur University, Laxminarayan Institute of Technology Nagpur, 440033, Maharashtra, India

^{2,3}Assitant Professor, Professor, Department of Oils, Fats and Surfactant Technology, RTM Nagpur University, Laxminarayan Institute of Technology Nagpur, 440033, Maharashtra, India

Abstract - In recent year's modification of vegetable oils gained a lot of importance due to its modified properties. Research activity throughout the world is to produce the ecofriendly product from biodegradable polymer. Availability of these petroleum products are limited therefore there is a need to replace these products with modified vegetable oils. In this article we study about the Environmental aspects and harmful effects of these petroleum products. Also we discuss why there has been demand on modified vegetable oils due to drawbacks of petroleum originated raw materials. Modifications of vegetable oil and their processes are discussed. The process of Malenization is used for modification of vegetable oils were maleic anhydride reacts with double bond of unsaturated fatty acids to produced maleinized oil. Among the all modification processes malenization of vegetable oils is best because it is helpful to decrease the use of petroleum products and increased the use of vegetable oils for gradually reduction of the environmental pollution.

Key Words: Modification, Soyabean oil, crude oil fractions, malenized oil, Environmental+ Effects.

1. INTRODUCTION

A] BROAD INITIATIVES: A variety of oil and fat derivatives owe their industrial importance to an ability to modify the surface behavior of the liquids in which they are dissolved.⁷ these derivatives are grouped under the broad designation of "surface active agents" of surfactants according to their principle use, they are conveniently classified as detergents, wetting agents, frothing agents etc⁸. Chemical and physical properties of vegetable oils are modified to enhance their use as additives or as major component for making fuels, lubricants, inks, paints and other industrial materials. Innovative technologist has been developed to increase the use of vegetable oils in industry by improving their oxidative stability, texture quality and high temperature stability.⁸ Generally detergents are based on LABS or Alpha-Olefin Sulphonates (AOS). These can certainly replace partially, if not completely in the detergents with renewable resources based on the vegetable oils.

Most of the petroleum products are nonrenewable materials like sodium bisulphate, HCl, sodium bisulphite, synthetic and acrylic resins and volatile organic solvents².

These are replaced by renewable source materials like vegetable oils. Vegetable oils are used because of its universal availability, inherent biodegradability, and lower cost of raw materials, lower atmospheric pollution, and lower toxicity to environment. By using disposal problems can be minimized.

The fractions obtained from distillation of crude oil can be used for many industries like paint, detergent, surfactants, cosmetics etc. these fractions are nonrenewable hence there is a need to develop a renewable materials include vegetable oils⁹. These vegetable oils can be modified in such a way that final modified oil can be used in formulations of many industrial products¹.

Alkyd resin is one of the most important ingredient in paint industry has 50% or more than 50% of both phthalic anhydride and maleic anhydride which are derived from petroleum origin¹. In alkyd synthesis 50% of materials are of petroleum origin and in our research these can be replaced by 80-90% of modified vegetable oils. Some other examples of petroleum products include: organic solvents like xylene, benzene, toluene also linear alkyl benzene sulphonate (LABS) is used to a very large extent in detergent industry.

Generally vegetable oils like soy bean oil, castor oil, mustard oil, Sesame oil are used in modified form like several methods by using malenization process.

B] ENVIRONMENTAL ASPECTS AND ADVERSE EFFECTS OF CRUDE OIL FRACTIONS:

Availability of sources: They are derived from petroleum fractions of distillation column. and its sources are limited and hence once used it gets exhausted and can run out for the next generation¹⁰. In fact, petroleum company's find it is very hard to extract the petroleum products from their sources and therefore they are now exploring the deep oceans and new area. If it is not found, then there won't be enough left to sustain the world.

Pollution of air and water: It leads to the environmental pollution, pollute the air and contributes in greenhouse gases and leads to the global warming¹¹.

It produces hazardous substances: Production of petroleum can produce harmful and very toxic hydrocarbons

including mixture of Sulphur, HO_x, SO₂ and other compounds, which elements of harmful gases carbon monoxide¹⁰. The consumption of petroleum in vehicles may leads to the high emission of CO₂ and other harmful gases which can affect respiratory system.

Health Hazard: Production of petroleum can lead to the disposal of pollutants. If these pollutants are not disposal properly then it pollutes water and people drink polluted water results health diseases including asthma and pneumonia¹¹.

Pollution of Marine Life: If these products were transported in marine water can cause oil spill also it affects adversely to all marine plants and animals. Shell life of plants gets decreased¹⁰.

It is non Renewable form of energy: These products cannot be regenerated once used or burn to generate electricity it exhausted. Their supply are limited therefore there is need to generate renewable product which save the entire world from their harmful effects¹⁰.

BIODEGRADIBILITY: Petroleum fractions obtained from crude oil are nonrenewable materials. These are long chain branched polymeric structure of unsaturated fatty acids¹⁴. It contains large number of Carbon and Hydrogen atoms linked together in branched structure. Therefore, biodegradability of these petroleum products are less as compared to modified vegetable oils. Time required for degradation of this petroleum products is too long hence there is need to replace these products with renewable materials like vegetable oils¹².

CASE STUDY: The crude oil concentration is greatly influenced by the degradation of crude oil by the free bacterial consortium. The increase in the concentration of the crude oil led to the decrease in the degradation by free bacterial consortium¹⁴. From fig.1 it is shown that when the concentration of crude oil increased the time required for the degradation is also increased. Near about 7-8 days are required for degradation of crude oil. From fig. 2 it is shown that time required for the degradation of malenized oil is 2-3 days.

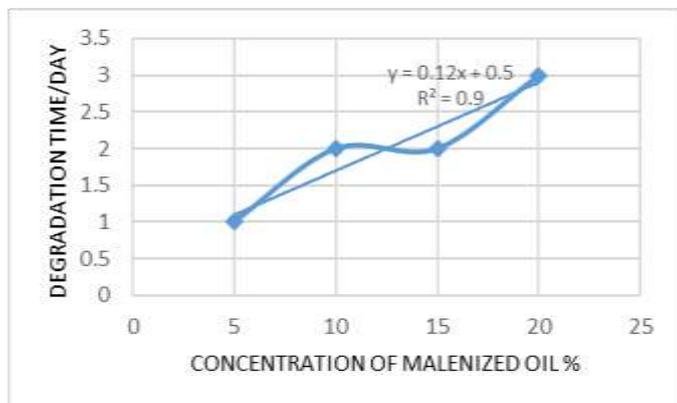


Chart -1

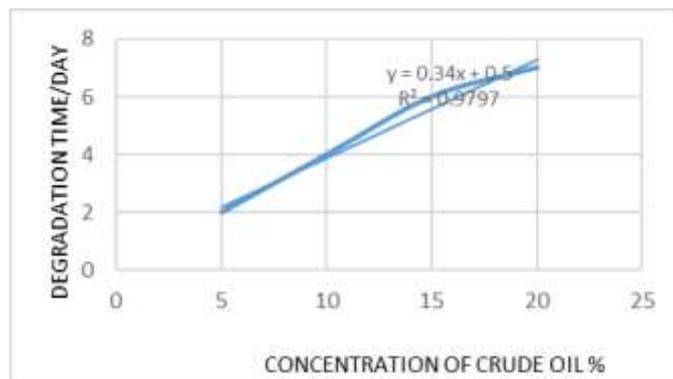


Chart -2

CRUDE OIL/PETROLEUM: THE NEED TO REPLACE-

Petroleum crude oil products obtained from crude fractions of distillation are nonrenewable and its stock is limited⁵. Sustainability of these petroleum originated fraction is of more concern.

C] MODIFICATION OF VEGETABLE OILS:

Modification of vegetable oils is used to improve the both physical and chemical properties of oils specially color and gloss. In paint industry these modified oils are used to improve water resistance, hardness, drying rate in paints. Many processes are used for modification of drying oils⁴:

Segregation: The oil is treated with a solvent with which it is not completely miscible and is allowed to stand. Two layers are formed which differ in the ratio of oil to solvents⁴. Here, partial separation of fatty acids from saturated to unsaturated glycerides takes place. This fraction affects drying time as compared to parent oil.

Reaction with unsaturated compounds: The unsaturated compounds are those which reacts with the double bonds in the unsaturated fatty acid chains⁴. The most widely used compounds are maleic anhydride, cyclopentadiene and styrene.

D] WHY MALENIZATION:

From all above processes malenization is used in this study. Here the compound maleic anhydride reacts with double bond of unsaturated fatty acid². Maleic anhydride can react with both conjugated and isolated double bonds. In this study vegetable oil gets modified with the addition of maleic anhydride to give maleinized oil. Mostly modified (maleinized) oil is used because it gives highest yield near about 95-98% with the addition of small amount of catalyst like HCl, sodium bisulphate and sodium bisulphite. Malenization process is used because time required for complete the reaction is less. It is not form a complex reaction. It will not form a gel due to long term heating. Malenization gives good quality of smooth polymer².

E] INDUSTRIAL USES OF MALEINIZED VEGETABLE OIL:

Maleinized vegetable oil is then used in special paints to improve glossy effect color and water resistance of

paints³. Also malenized Oil can be used in the soap manufacturing. When castor oil is treated with maleic anhydride under suitable temperature conditions maleinized castor oil is obtained which provide wonderful quality of soap with improved hardness than that of parent castor oil⁶. Hence, malenization process is used as compared to other processes.

F] HAZARDOUS EFFECTS OF SOLVENTS USED IN PAINT INDUSTRY:

PAINT: Solvent based paint is manufactured by addition of pigment, oil and solvents and all these raw materials are added into the mixing tank especially ball or roller mill then thinning and tinting takes place with the addition of thinners³. Then finally it gets packed and shipped. Here, solvents used are Terpenes commonly used as turpentine, aromatic hydrocarbons, alcohols, esters, nitro and chloroparaffins they are toxic in nature and costly these can be replaced by modified vegetable oils to minimize the adverse effects.

A wide range of hydrocarbon solvents used in paint formulations: Aliphatic compound, (white spirit), Aromatic compound (Xylene, toluene), ketones, esters, alcohols, glycol ethers, ethers. Most of these solvents are produced in petroleum industry as volatile fractions in refinery of crude oil¹³. Some solvents are prepared from plants ex. Turpentine produced by the distillation of resin obtained from pine trees. There effects:

- Solvent based paints are very toxic in nature.
- Hydrocarbon solvents are evaporating faster because of their volatile nature and enters into human body through breathing cause's nausea, frequent headache, and effect central nervous system and many more.
- Solvents used in paint industries are highly flammability i.e. lower flash point and auto ignition point.

3. CONCLUSIONS

In this article we study about the various environmental aspects and their harmful effects of petroleum products widely used in paint industries. Also study about the different modification processes of vegetable oils to obtained environment friendly maleinized oils which are nontoxic, biodegradable, and have high flash points. Here, we study about alkyd resin in which 50% of maleic and phthalic anhydride is replaced by eco-friendly modified vegetable oils by using the process of malenization mostly used in paint industry. Therefore, based on the present review, it may be concluded that malenization process can be considered as a key component from all modification processes.

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