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RESEARCH ARTICLE OPEN ACCESS

A Review on Manufacturing of grease from neem seed oil, vegetable oil and scrap oil.

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ABSTRACT:
Grease is a semi-solid or solid lubricant consisting of a thickening agent in a liquid lubricant. It is made by combining base oils, thickeners, and additives. The type of base oil and thickener used will determine the properties of the grease, such as its viscosity, temperature range, and load capacity.Grease has a wide range of applications in both industrial and consumer settings. It is used to lubricate and protect moving parts in a variety of equipment, such as automobiles, machinery, and appliances. Grease can help to reduce friction and wear, extend the lifespan of equipment, and improve performance.

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I. INTRODUCTION:

Grease, a fundamental component in the realm of lubricants, plays a pivotal role in the smooth operation and longevity of machinery across diverse industries. Unlike liquid lubricants, grease is a semi-solid mixture consisting of a base oil, a thickening agent, and various additives, collectively forming a viscous and adhesive substance. This unique composition imparts grease with exceptional adherence properties, enabling it to adhere to surfaces and provide effective lubrication even in challenging conditions.

This introduction aims to unravel the significance of grease in the intricate machinery landscape.

The manufacturing and application of grease involve a nuanced understanding of the specific requirements of the machinery it serves. Grease acts as a protective barrier against friction, wear, and corrosion, thereby enhancing the performance and reliability of mechanical components. Its versatility is evident in applications ranging from automotive systems to industrial machinery, where it serves as a critical element for minimizing friction-induced heat and preventing premature wear and tear. This introduction aims to unravel the significance of grease in the intricate machinery landscape. As we delve deeper into its formulation, properties, and applications, comprehensive understanding of the indispensable role that grease plays in ensuring the efficiency and durability of mechanical systems will emerge. From its humble beginnings in the manufacturing process to its diverse applications in real-world scenarios, grease stands as a silent yet essential partner in the seamless functioning of machinery across various sectors.

RAW MATERIALS:

Lithium grease: Lithium grease is a common type of grease that is used in a wide variety of applications. It is made with lithium hydroxide thickener and a mineral oil base.

Calcium grease: Calcium grease is another common type of grease that is known for its water resistance and high-temperature performance. It is made with calcium hydroxide thickener and a mineral oil base.

Aluminum grease: Aluminum grease is a type of grease that is known for its shear stability and extreme pressure performance. It is made with aluminum hydroxide thickener and a mineral oil base.

Synthetic grease: Synthetic grease is made with synthetic base oils and thickeners. Synthetic greases are often used in applications where high temperature performance, water resistance, or shear stability is required.

Grease manufacturers carefully select the right raw materials to produce greases with the desired performance characteristics. Grease is a complex product, and the selection of the right raw materials is essential to producing a high-quality product.

Chemicals:
Chemical Products for Industrial Lubricants and Greases
For industrial lubrication and grease manufacturing, we offer the following chemical products:
Acids:
The acids we supply for use in lubricants and grease are:

Adipic acid:
Adipic acid is a white, slightly soluble, and mildly toxic compound. Manufacturers typically use it in the production of nylon 66, but it can also facilitate the manufacture of plasticizers and lubricants. Food grade varieties are also used as a gelling aid or leavening agent.

Azelaic acid:
This dicarboxylic acid is often used in skincare and acne treatments as a gentle exfoliant and surface cleanser. However, it also acts as a thickener in lithium complex greases and an intermediate in polymer or plasticizer production.

Boric acid:
Manufacturers use this weak boron-based acid as a pH buffer and a lubricant for ceramic and metal surfaces and carrom boards.

Base Oils:
Base oils are heavy oils separated from crude oil during refining processes. Most base oils have a boiling point between 280° C and 550° C and can be used to produce motor oils and lubricating greases by combining them with additives. Depending on their viscosity and other characteristics, they can be categorized into one of five groups:

- **Group I:** base oils that have a viscosity index between 80 and 120, more than 0.03% sulfur content, and <90% saturates
- **Group II:** base oils that have a viscosity index between 80 and 120, less than 0.03% sulfur content, and ≥90% saturates
- **Group III:** base oils that have a viscosity index of ≥120, ≤0.03% sulfur content, and ≥90% saturates
- **Group IV:** polyalphaolefins (PAO) base oils with a viscosity index between 125 and 200
- **Group V:** any base oils not previously categorized as Group I, II, III, or IV base oils.

Castor Oil Derivatives:
For centuries, castor oil has been used to produce, among other things, coatings, lubricants, and soaps. Compared to other oils, it offers greater viscosity, density, and heat conduction. The presence of ricinoleic acid in its composition also provides oxidative stability and long shelf life. In addition to its use in lubricants and greases, manufacturers employ the compound during the manufacture of biodiesels, biodegradable polymers, food-grade gellants, and more.
The castor oil derivatives we offer are:

- 12-hydroxy stearic acid
- Hydrogenated castor oil
- Sebacic acid (granular and powder)

Corrosion Inhibitors:
Corrosion inhibitors are materials that create a protective layer on metal surfaces that prevents corrosion from developing. Choosing the right corrosion-inhibiting mechanism is important. Manufacturers should consider the environmental and safety factors, such as how the material can react with nearby equipment or human operators and what type of corrosion risks are present in the environment. They can also select corrosion inhibitors based on the thickness of the film they want, how long the inhibitor needs to be effective, and the protected metal itself.
The following corrosion inhibitors are:

- Benzotriazole
- Dodecanedioic acid
- Sodium tolyltriazole
- Tolyltriazole
- Undecanedioic acid

Oleochemicals:
Oleochemicals are organic substances derived from natural sources such as plant-based and animal-based fats. They are used to create a variety of industrial and consumer goods, such as lubricants, plastics, and rubbers or cosmetic and personal care products.
The oleochemical products we supply include the following:

- Capric acid
- Caprylic acid
- Distilled tall oil
- Fatty acid
- Fatty alcohol
- Lauric acid
- Methyl ester
- Stearic acid

Specialty Esters :
Esters are hydrocarbon-based organic compounds. Compared to carboxylic acids, they are more volatile. Additionally, they are partially soluble in water, do not bond to themselves, and can have more fragrant odors. Depending on their specific properties, manufacturers use them for different applications. For example, esters with attractive scents are used in perfumes, while polyesters are used in plastics.

Various methods for production of grease are:
1.GREASE FROM NEEM SEED OIL:
The manufacturing of grease from neem seed oil can be divided into two main steps:

1. Extraction of neem seed oil
2. Production of grease

Extraction of neem seed oil:

1. There are two main methods for extracting neem seed oil: mechanical extraction and solvent extraction.
2. Mechanical extraction involves crushing the neem seeds and then using a press to extract the oil. This method is relatively simple and inexpensive, but it can produce oil with a high impurity content.
3. Solvent extraction involves soaking the neem seeds in a solvent, such as hexane, to dissolve the oil. The oil is then separated from the solvent using evaporation or distillation. This method produces a higher quality oil, but it is more expensive and complex than mechanical extraction.

Production of grease :
Grease is produced by mixing a base oil with a thickener. The base oil is typically a mineral oil, but it can also be a vegetable oil, such as neem seed oil. The thickener is a soap, such as lithium 12-hydroxy stearate, that gives the grease its solid or semisolid consistency.To produce grease from neem seed oil, the oil is first heated to a temperature of around 90°C. The thickener is then added and the mixture is stirred until it is well combined. The grease is then cooled and packaged.
Example of a process for manufacturing grease from neem seed oil

1. Extract neem seed oil using a solvent extraction method.
2. Heat the neem seed oil to 90°C.
3. Add lithium 12-hydroxy stearate thickener and stir until well combined.
4. Cool the grease and package it.

Properties of neem seed oil grease :
Neem seed oil grease has a number of desirable properties, including:

- High biodegradability
- Good thermal stability
- Good oxidation resistance
- Good anti-wear properties
- Good water resistance

Neem seed oil grease can be used in a variety of applications, including:

- Automotive applications, such as wheel bearings and chassis lubrication
- Industrial applications, such as gearboxes and bearings
- Agricultural applications, such as tractor and harvester lubrication

Neem seed oil grease is a sustainable and environmentally friendly alternative to petroleum-based greases.

2.GREASE FROM VEGETABLE OIL:
The manufacturing of grease from vegetable oil is a similar process to manufacturing grease from mineral oil. The main difference is that vegetable oils are more susceptible to oxidation, so additional steps must be taken to protect the grease from degradation.
1.Extraction of vegetable oil :
Vegetable oil can be extracted from a variety of plants, including soybeans, rapeseed, sunflower, and canola. The most common extraction method is solvent extraction, which uses a solvent such as hexane to dissolve the oil out of the seeds.
2.Purification of vegetable oil
Once the oil has been extracted, it needs to be purified to remove any impurities. This can be done using a variety of methods, such as filtration, centrifugation, and washing.
3.Epoxidation of vegetable oil
Epoxidation is a chemical process that adds oxygen atoms to the double bonds in the fatty acids that make up vegetable oil. This process improves the oxidation resistance of the oil and makes it more suitable for use in grease.
4Thickening of vegetable oil :
The vegetable oil is thickened by adding a soap, such as lithium 12-hydroxy stearate. The soap reacts with the fatty acids in the oil to form a solid or semisolid grease.
5.Addition of additives:
Various additives can be added to the grease to improve its performance, such as extreme pressure (EP) additives, anti-wear additives, and corrosion inhibitors.

6.Cooling and packaging:
The grease is then cooled and packaged for sale.Properties of vegetable oil greaseVegetable oil grease has a number of desirable properties, including:

- High biodegradability
- Good thermal stability
- Good oxidation resistance
- Good anti-wear properties
- Good water resistance

Vegetable oil grease can be used in a variety of applications, including:

- Automotive applications, such as wheel bearings and chassis lubrication
- Industrial applications, such as gearboxes and bearings
- Agricultural applications, such as tractor and harvester lubrication

Vegetable oil grease is a sustainable and environmentally friendly alternative to petroleum-based greases.
Challenges
One of the main challenges in manufacturing vegetable oil grease is its susceptibility to oxidation. Vegetable oils contain unsaturated fatty acids, which are more prone to oxidation than saturated fatty acids. Oxidation can degrade the grease and reduce its performance.
To address this challenge, vegetable oil grease manufacturers often add antioxidants to the grease. Antioxidants help to prevent oxidation by reacting with free radicals, which are the molecules that initiate the oxidation process.

- Another challenge in manufacturing vegetable oil grease is its tendency to form soap scum. Soap scum is a white or gray film that can form on surfaces when soap reacts with minerals in water.
- To reduce the formation of soap scum, vegetable oil grease manufacturers often use synthetic soaps or blend vegetable soaps with mineral soaps. Synthetic soaps are less likely to form soap scum than vegetable soaps, and mineral soaps are not susceptible to soap scum formation.
- Despite these challenges, vegetable oil grease is a viable and sustainable alternative to petroleum-based grease. Vegetable oil grease is becoming increasingly popular as businesses and consumers look for ways to reduce their environmental impact.

3.GREASE FROM SCRAP OIL:
The manufacturing of grease from scrap oil is a similar process to manufacturing grease from vegetable oil or mineral oil. The main difference is that scrap oil typically contains more impurities, so additional steps must be taken to remove these impurities before the oil can be used to make grease.
Process:
1.**Collection and storage of scrap oil**
Scrap oil can be collected from a variety of sources, such as automotive service stations, industrial facilities, and restaurants. The oil should be stored in a sealed container to prevent contamination.
2.Pretreatment of scrap oil
The scrap oil must be pretreated to remove any impurities, such as water, solids, and acids. This can be done using a variety of methods, such as filtration, centrifugation, and washing.
3.Epoxidation of scrap oil
Epoxidation is a chemical process that adds oxygen atoms to the double bonds in the fatty acids that make up scrap oil. This process improves the oxidation resistance of the oil and makes it more suitable for use in grease.
4.Thickening of scrap oil
The scrap oil is thickened by adding a soap, such as lithium 12-hydroxy stearate. The soap reacts with the fatty acids in the oil to form a solid or semisolid grease.
5.Addition of additives
Various additives can be added to the grease to improve its performance, such as extreme pressure (EP) additives, anti-wear additives, and corrosion inhibitors.
6.Cooling and packaging
The grease is then cooled and packaged for sale.One of the main challenges in manufacturing grease from scrap oil is the variability of the oil.Scrap oil can come from a variety of sources and can contain a variety of impurities.This can make it difficult to produce a consistent grease product.
To address this challenge, grease manufacturers often use a variety of blending techniques to combine scrap oil with other oils, such as vegetable oil or mineral oil. This helps to reduce the variability of the scrap oil and produce a more consistent grease product.
Another challenge in manufacturing grease from scrap oil is the potential for contamination. Scrap oil can contain a variety of contaminants, such as heavy metals and polychlorinated biphenyls (PCBs). These contaminants can be harmful to human health and the environment.

PROCEDURE:
1. Charge scrap oil/ vegetable oil / neem oil
In pilot kettle and simultaneously add HCO & 12-HSA (Hydroxystearic acid) in oil.

2. Start the stirring & increase temperature upto 100 C.
3. When HCO & 12 HSA meltdown then add LiOH (dissolve in water) in oil.
4. When LiOH is added, then immediately starts soap formation in kettle.
5. If foam comes out then add antifoaming agent.
6. Silicon oil works as a antifoam.
7. Continue heating and spray 100 ml water to reduce the alkalis.

FORMULA:

Mol. Wt. of LiOH*0.5 HCL*B.R
Sample weight

FORMULATIONS FOR GREASE:

1. There are four steps involve in the formulation of grease. The first step is all the materials are prepared in the desired amount.
2. The second step is preparation of smooth paste. The desire amount of fumed silica and red gypsum is slurred with ½ of the require amount of waste oils with a continuous stirring.
3. Then, the third step is, continuous mixing and heating at a maintain temperature. Lastly, the forth step is addition and continuous mixing.
4. The rest ½ of the waste oils, iron octoate and molybdenum disulphide add slowly into the smooth paste. The mixing and heating process continue for 6 hours. The grease is prepared for 1kg for each ratio.

Humidity or Moisture %

(W_1-W_2)/W_1×100%.....(1)

Where: W_1 = original sample of weight earlier drying. W_2= sample of Weight after drying Size Reduction and balancing the sample for oil extraction The humidity was detached by placing the sample in a sun for 6 days from 25°C to 30□.

The dried filter mud was crushed by hand with a sieve size of 1 mm- 2.5 mm. The sample was sieved with a set of sieves sizes arranged in 1 - 1.5 millimeter, 1.5 - 2 millimeter, 2 -2.5 millimetre's to get sizes to investigate the effect of elements size on yield and amount of oil.

DEMAND AND SUPPLY OF GREASE:

The demand for grease is driven by a variety of factors, including:

Industrialization and economic growth: As economies grow and industrialize, there is an increasing demand for grease to lubricate and protect machinery and equipment in a wide range of industries, including automotive, manufacturing, construction, and mining.

Increasing urbanization: The growth of cities and the development of new infrastructure is also driving demand for grease. Grease is used in a variety of applications, such as road construction, building maintenance, and transportation.

The supply of grease is largely determined by the availability of base oils and thickeners. Base oils are typically derived from petroleum, while thickeners can be made from a variety of materials, such as lithium, calcium, and sodium. The supply of these raw materials can be affected by a number of factors, such as weather events, geopolitical instability, and economic conditions.

I. In recent years, the global grease market has seen a steady increase in demand. This is due to the factors mentioned above, as well as the growing popularity of synthetic greases. Synthetic greases offer a number of advantages over traditional mineral-based greases, such as better performance in extreme temperatures and longer service life. This has led to increased demand for synthetic greases in a variety of industries, such as automotive, aerospace, and food processing.

II. Overall, the demand for grease is expected to continue to grow in the coming years. This is due to the continued growth of the global economy,industrialization,and rising urbanization. The supply of grease is also expected to grow, but it is important to note that the supply of base oils and thickeners can be affected by a number of factors.

III. Here are some specific examples of the demand and supply of grease in different industries:

IV. **Automotive**: The automotive industry is the largest consumer of grease, accounting for over half of global demand. Grease is used in a variety of automotive applications, transmissions, bearings, and chassis components. The demand for grease in the automotive industry is driven by the growing production and sales of vehicles, as well as the increasing complexity of vehicle designs.

V. Manufacturing:

The manufacturing industry is another major consumer of grease. Grease is used to lubricate and protect machinery and equipment in a wide range of manufacturing processes, such as metalworking, food processing, and papermaking. The demand for grease in the manufacturing industry is driven by

the growth of global manufacturing and the increasing use of automation.

VI. **Construction:**
The construction industry is also a major consumer of grease. Grease is used to lubricate and protect machinery and equipment used in construction projects, such as excavators, bulldozers, and cranes. The demand for grease in the construction industry is driven by the growth of global infrastructure spending.

VII. **Mining:**
The mining industry is another major consumer of grease. Grease is used to lubricate and protect machinery and equipment used in mining operations, such as drills, conveyors, and loaders. The demand for grease in the mining industry is driven by the growing global demand for minerals.

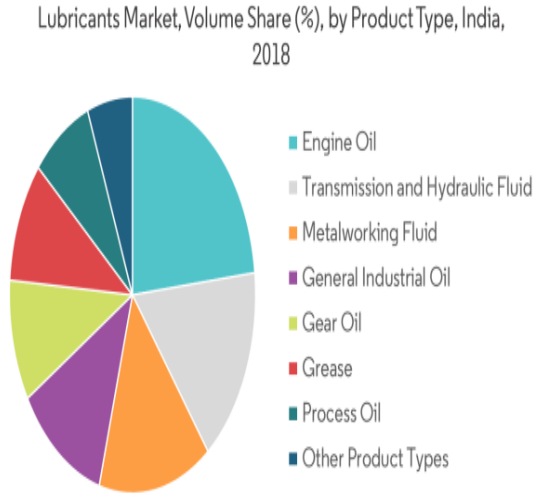
VIII. The supply of grease is concentrated in a few major regions, such as North America, Europe, and Asia Pacific. The major suppliers of grease include Royal Dutch Shell, ExxonMobil, Chevron, BP, and TotalEnergies. These companies operate manufacturing plants and distribution networks around the world.

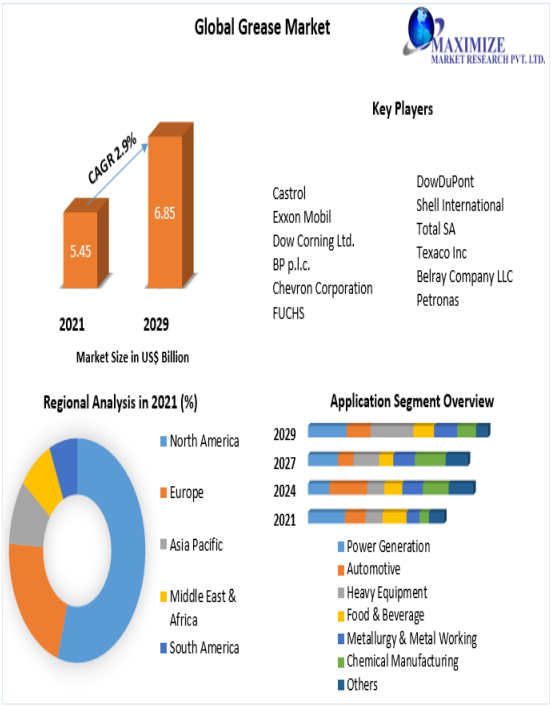
IX. The grease market is a competitive one, with a number of companies offering a wide range of products. The major players in the market are constantly innovating to develop new and improved grease products. This is helping to drive the growth of the grease market and meet the growing demand for grease from a variety of industries.

Tests will be conducted by lab for this experiment:
1.Base oil
2.Dropping point
3. Copper corrosion
4. Cone penetration
5. Water resistance
6. Corrosion protection
7. Load bearing capacity
8. Wear resistance

II. RESULTS AND DISCUSSIONS:

Grease has a high initial viscosity, which reduces when sheared, giving the impression of an oil-lubricated bearing of about the same viscosity as the base oil used in the grease.The lubricating characteristics of grease originate from oil in this network.





III. CONCLUSION:

Greasse is a versatile and important lubricant that is used in a wide range of applications. It is made by combining base oils, thickeners, and additives to form a thick, viscous material that can provide lubrication and protection for moving parts under a variety of conditions. It is important to choose the right grease for the specific application and to use it properly to avoid the disadvantages of grease.

As we move forward, it is essential to build upon these findings, fostering innovation and sustainability in the field of grease research and application.

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