

BIOLUBRICANT PRODUCTION IN NIGERIA: PERSPECTIVES ON CHALLENGES AND STRATEGIC ACTIONS FOR SUSTAINABLE PRODUCTION FROM UNDERUTILIZED OIL SEEDS

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Abstract:

The prospect of Nigeria topping the world and Africa in the production of biofuel and oleo-chemical, it is appraised that 40% of all lubricants are discharged into the environment. Biolubricant is a substitute emollient different from conventional inorganic oil lubricant as produced from biodegradable, environmentally friendly, Renewable and non-toxic materials. Nigeria has great potential for production of biolubricant from edible and non-edible oilseeds. From about 1000 varieties of oilseeds available, only fewer than ten varieties have been detailed so far, like (Jatropha seed oil, neem seed oil, castor seed oil, mango seed oil, flamboyant seed oil, soya seed oil, fluted pumpkin seed oil. Biolubricant production in many developed countries from edible seed oil has increased the rate of cultivation and reduced the rate of unemployment in the country due to the increased demand for oil seeds. Nigeria can key to the production of biolubricants to diminishing the outflow of the country foreign-currency funds for lubricant will allow Nigeria to rise its increasing foreign exchange reserves which can be improved expended on expenditures capital for manufacturing production and inputs. Many researches have been carried out on the production of biolubricants, the real test still remains the requirement for advanced hardware for the production of biolubricants and specialized techniques that can deal with how to build up the types of paraphernalia required for biodiesel and biolubricants manufacture that will embrace the global change to the utilization of biodegradable fuel, lubricants and materials. Overview of lesser, quicker, more efficient equipment operational at developed speeds, moderate temperatures, anxieties free and less compressions to favours developed quality lubricants.

Keywords: Convectional; Eco-friendly; Global; Lubricant; Oilseed; Oleo-chemical.

1.1 INTRODUCTION:

Lubrication is important in practically every feature that has contributed to the expansion of our civilisation to the contemporary day (industry, transportation, construction, maintenance, households, etc). The main property of a lubricant is scrape lessening or side-stepping the direct contact of two surfaces in diverse systems. (Ponnekanti and Savita 2012; Amit *et al.*, 2013). Numerous liquids used as lubricants are inorganic oil based. Because of their low-slung biodegradability also significant toxicity, inorganic oils are not environmentally responsive. The environment is becoming increasingly contaminated with numerous kinds of pollutants, so any decrease is beneficial (Salimon *et al.*, 2010). There are around 7895 plant types from 338 families and 2215 for the most part that have been perceived in Nigeria out of which 0.4% are meticulous undermined and 8.5 % compromised. One hundred and forty-six species on the IUCN rundown of undermined species are found in Nigeria out of which 18 falls under the class 'imperilled' and 15 under the classification fundamentally jeopardized'. The land use characterization of Nigeria's 923 768 square km shows that 34% is included by crops, 23 % by meadow and 16 % backwoods. Around 13% is reserved by waterways, lakes and repositories, and the staying 14% drop under different employments. Inside the past a quarter century, it is accepted that around forty three percent of the timberland biological system has been lost (FAO, 2011). Agriculture is tactical to the Nigerian economy supplying diet for the country's 140 million people (2005 census), raw materials for industries, receiving overseas exchange which is next only to that from crude oil (CPGRF&A, 2008).

1.2 Demerit of conventional mineral oil Lubricants

It is estimated that 40 % of all lubricants are discharged into the environment. Basic disposal strategies incorporate recycling, copying, landfill and release into water, which is one of the major constraints in developing countries like Nigeria, and these factories are not put into consideration to get a safe environment for living.

Conventional lubricants produce a non-clean, highly toxic working environment, burning of lubricant as fuel typically to generate power is likewise administered; chiefly controls cannot be introduced because generally abnormal state of added substances exhibited in production of lubricants. Smouldering of lubricant creates both airborne poisons and cinder rich in poisonous

materials, predominantly overwhelming metal mixes and fewer skin problems for those working with engines and hydraulic systems (Mobarak *et al.*,2014).

Convectional lubricant has poor safety due to low flashpoints, unstable viscosity, less oil mist and non-vapour emissions. Produce large amount emissions due to low boiling point temperature ranges of mineral oil used, highly non-biodegradable, Costs high over the product's life-cycle due to high maintenance, storage and disposal requirements (Haas, 2005).

Comprehensive utilisation of by-products formed from food and agricultural industrial productions is one of the most significant part in economical assets and the substantial task in environmental guard at the same time. There are abundant possibilities for production of bio-products by biotechnological progressions, among them biolubricants and biofuels involved the most attention (Watanabe *et al.*,2000; Ponnekanti and Savita, 2012). Assembling side-effects can be prepared by a few biotechnological strategies. Lubricant are utilized in different modern and upkeep applications all through the world. A portion of the huge applications are; Manufacturing Oils utilized for modern purposes comparable motor oils, water driven oils, metal utilized liquids and blower oils and so forth. Car Oils utilized in the vehicle and transport industry like motor oils, transmission liquids, gearbox oils, brake and water powered liquids and so forth. Unrivalled Oils utilized for particular purposes according to indicated activities like procedure oils, white oils, persuasive oils and so on (Amit *et al.*,2013). Bio-lube give noteworthy remunerations as an elective emollient for mechanical and support asserts because of their boss characteristic characteristics.

Biolubricants because of their ecological advantages empower their utilization in touchy conditions and give contamination avoidance. Biolubricants have ability of being used in different mechanical and support applications.

1.3 Disadvantages Biolubricant over Petroleum Based Lubricant

Fuel based emollients had a huge cost advantage over biolubricants thus fuel has been the base oil of monetary decision, A survey has been completed to set up the faults of biolubricants (Ponnekanti and Savita 2012; Environmentally Preferable Purchasing Fact Sheet, 2011); biolubricants have a couple of insults in the use time of the thing life cycle, including: Some horrendous fragrances if contaminants are accessible, high consistency at low temperatures, Vegetable oils in their

characteristic structure need adequate oxidative steadiness for grease use. Low oxidative strength implies the oil will oxidize rapidly during use if untreated, the ointment getting thick and polymerizing to a plastic-like consistency (Ponnekanti and Savita 2012 ; Murphy *et al.*, 2002). Poor oxidative security at high temperatures, in spite of the fact that added substances composed particularly for plant-based ointments kill soundness issues identified with outrageous high and low temperatures. In the event that biolubricants is untreated, it needs corrosion dependability with high content pour point (Lou, 2008). Few difficulties connected with the generation of biolubricants which incorporate the high cost set up production plant and constrained accessibility of biolubricants feedstock. There are different components adding to the cost of biolubricants(Ponnekanti and Savita 2012). These components incorporate feedstock quality, handling innovation, feedstock costs, plant's capacity, net energy stability nature of distillation and many others (Haas, 2005). Notwithstanding, the two primary variables are the expenditures of feedstock and the cost of handling into biolubricants. It has been found that the cost of feedstock accounts for seventy-five percent (75%) of the aggregate price of biofuels and biolubricants in general: (Ponnekanti and Savita(2012); Miao and Wu (2006).

2.1 Underutilised Seeds for Biolubricants production in Nigeria.

The economic importance of oil crops has made it necessary that they be properly investigated, to ascertain their oil quality parameters, since this is an important criterion for marketing and processing of oil seed for solving human needs. The level of deterioration of the oil seed in developing countries due to lack of proper storage medium, modern biotechnological processing methods and utilization. Nigeria is one of the countries of the world with almost a thousand varieties of oil seeds notably edible and non-edible.

Considerable research work has been carried out on some oil seeds for production of biofluid in some developing countries, seeds like: *Jatropha* seed, almond seed, castor seed, fluted pumpkin, palm kernel seed, groundnut, mango seed, kola nuts, palm nut, were reported by Afolabi, 2008; Eze, 2008; Bilal *et al.*, 2013; Ibitoye, 2014; Matthew *et al.*, 2015; Mohammed *et al.*, 2015.

Research has shown production of biolubricants from fluted pumpkin as reported by Matthew *et al.*, 2015 on process streamlining and energy of biolubricant amalgamation from fluted pumpkin seed. Fluted Pumpkin Biolubricant (FPBL) was blended by transesterification of fluted pumpkin

methyl ester (FPME) and trimethylolpropane (TMP) utilizing calcium hydroxide, $\text{Ca}(\text{OH})_2$ impetus. First and second order Kinetic models were dissected to pick the ideal

one in regards to their relative straightforwardness and precision of fitting the trial information acquired at various working conditions. The second order kinetic model gave the best fit. Palm kernel oil was used as feedstock in the production of biolubricants by Ibitoye, 2014. Which Palm kernel oil was converted to biodiesel by acid esterification and base transesterification with the process of transesterification to biolubricant using potassium hydroxide (KOH) and trimethylolpropane as catalyst and additive for the process of lubrication. The physical properties were also characterised, such as viscosity at 40 °C to be 40.9 cSt, viscosity at 1000C to be 9.8 cSt, flash point to be 249 °C, pour point to be 19°C, specific gravity to be 0.889, acid value to be 0.2 of the lubricant were determined in the study and compare with standard conventional petroleum lubricant. The results show that palm kernel oil methyl ester successfully converted to TMP ester with 89.10 of TE at optimum temperature of 120oC, 0.5% (w/w) of KOH in 1hours reaction time.

Biniyam *et al.*, 2016 worked on the Production of Biolubricant from Castor (Ricinus) Oil and Employing renewable possessions and to resolve environmental issues related to inorganic fuel lubricants. In the study, an ignoble catalysed method was hired in the synthesis of oil (FAME) from castor seed oil. The research uses KOH catalysed transesterification in which supplementary variables disturbing the acid content and the methyl ester produce, such as molar ratio, catalyst concentration, rejoinder time and reaction temperature, were analysed according to studies of different literature review to determine the optimum yield of FAME from the seed oil (Biniyam *et al.*, 2016). The important properties of the base oil; density to be 0.888 ml/g, kinematic viscosity to be 34.1 cSt, pour point to be -5 °C, the evaluation with standard shows that the castor seed oil, alternative base oil for biolubricants can be methyl ester produced from Castor seed oil.

All the above research had shown a great potential of biolubricants as replacement of mineral based lubricant, if all developing can key into the utilization of this available seeds oil both edible and non-edible.

2.2 Prospect and Challenges of Biolubricants Production

The country Nigeria has mammoth potentials of oil seeds that contain biological characters and chemical components required for biofuel and biolubricant production, the prospect and challenges are discussed below:

A. Prospect

The pattern toward expanding execution and enhanced similarity kept amid the main contemporary quality propensities in lubricants indicate a substantial shift toward product specifications and viscosity ratings. In fact, biolubricants surpass the performance of inorganic fuel lubricants in terms of low carbon-forming tendency, oxidation stability, viscosity, volatility requirement, stability, and response to additives (Mobarak *et al.*, 2014).

Provided that better performing lubricants aimed at specific tenders in the lubricant manufacturing firms biolubricants development in Nigeria will entail the processing of non-edible vegetable seeds and cultivation which are very rich in oil content. Nigeria a country by means of climate types and diverse soil comprising several agro-ecological regions, provides ample opportunity to grow a variety of crops. Cultivation of these crops is labour intensive and as such they generate a lot of employment opportunities for the rural population.

Non-edible/ edible vegetable seeds have the potential to provide economic benefits at the local level as well as at national level. Developing new-generation heavy-duty lubricants will provide response to the industry demand for

lubricated automotive equipment that will reduce environmental loading by decreasing emissions and to achieve non-toxicity and biodegradability. Biolubricants are presently generally acknowledged as offering various inalienable execution preferences over conformist petroleum-based oils formulate modern automotive engine oils (Menezes *et al.*, 2012).

Nigeria can subscribe to the manufacturing of biolubricants to diminishing the expenditure of the country foreign-currency reserves for lubricant motivation will allow Nigeria to increase its growing foreign currency reserves which can be better spent on capital expenditures for industrial inputs and production). Since no food producing farmland is required for producing biolubricants it is considered the most politically and morally acceptable choice (Amit and Amit, 2012). Biolubricants have no negative impact on the production of the massive quantities of grains and

other vital agriculture goods. Nigeria produces to meet the food requirements of its massive population of the country. And since non-edible vegetable plants are carbon-neutral, large-scale production will improve the country's carbon emissions profile (Watanabe *et al.*, 2000; Mobarak *et al.*, 2014).

If the country can venture into the project of biolubricants production, it will initiate the country to minimize importing petroleum-based lubricants by replacing them with biodegradable and renewable lubricants which have improved characteristics than the recent one which will in turn decrease cost of importing, transportation. In this way the country will become energetically self-sufficient, no fear for the depletion of petroleum reservoirs. It also brings the county to a green economy system.

B. Challenges

Numerous researches have been conducted on the production of biolubricants, the factual assessment still leftovers the requirement for unconventional hardware for the manufacture of biolubricants and specialized techniques that can deal with how to build up the types of paraphernalia required for biodiesel and biolubricants manufacture that will embrace the global change to the utilization of biodegradable fuel, lubricants and materials. Introduction of smaller, faster, more efficient equipment operating at higher speeds, temperatures, stresses and pressures favours higher quality lubricants (Obasa and Adejumo, 2017). Autonomy from deposits, reduced maintenance, radioactivity resistance, greater efficiency, and larger unsolidified life are the supplementary potential advantages from devouring elective grease base stores. The greatest challenges are advancement of an all-inclusive biodegradable base stock that could supplant inorganic fuel oil base stocks in the new age of oils with the current consideration on the earth. Assembling administrators in parts of the world have started to welcome that some biolubricants, strikingly those dependent on non-eatable plant oils, offer cost dynamic grease in every single operational condition, when ecological concerns are perceived as being critical

3.1 Way forward:

Based on the information obtained from this study the following commendations were suggested: In order promote massive production and applications of biolubricants in Nigeria more research need to be conducted on

the thermal properties activities during production process; Proper understanding and development biotechnological control system need to locally build up in Nigeria; There are some poor characteristics attributed to biolubricants, there is need for research on blending and mixing of additives that can eliminate the constraints; Countries that have adopted the use biolubricants as their major source of lubricant commonly uses edible oil, research need to be conducted on many more oil seeds both non edible and edible seeds especially perishable seeds.

CONCLUSION

The possible challenges in using the available oil seeds cannot be over emphasized due to the facts that conservational factors are acquisition importance in the society and in the global community at large. Enormous volume of oil-based lubricant pollutes the earth during or after use, for the most part from spills and modern procedures. Ability of biolubricants as another ointments for upkeep and assembling tenders incorporate lower poisonousness, respectable greasing up properties, high thickness record, high start temperature, intensified hardware bundle. Manufactural firm can decrease device costs and improve creation quality in a more secure condition by changing to biolube and utilizing locally open materials for advancement of gear and instruments attractive for creation. Biolubricants diminish expenses of system maintenance, increase competitiveness, and provide a healthier environment. There is urgent need for full exploration of environmentally friendly varieties lubricant to fight the common cause affecting living beings.

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