

Mini Review

Biotechnology: A way to Control Environmental Pollution by Alternative Lubricants

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Environmental concerns are gaining lot of interest due to increasing environmental pollution. Pollution is caused from various sources like fuel, lubricants, industrial waste, chemicals, noise etc. One of the major source of pollution is lubricant as it directly affect the environment when it is handled improperly, as lubricants from petroleum based oils have very poor biodegradability and also have high toxicity. Environmental pollution can be controlled by the use of biotechnology in the field of alternative lubricants from different available biomass. The current paper deals with the ways of reducing the environmental pollution by various alternative resources.

Keywords: Alternative lubricants, Renewable resources, Non edible vegetable oil, Environment, Pollution.

Environment: In simple words environment is defined as "All the human, animal and plant lives or a function in surroundings is known as environment." Environment also comprises of water, air, soil etc. From the definition it is very clear that a healthy and clean environment is very important for all the living being. Environment is disturbed by any substances which affect or change the proper functioning of environment; these substances are generally termed as pollutants. These pollutants are of various types and have various harmful effects, which can highly affect the environment and causes various types of problems to all types of living beings existing in the environment.

Pollution: Pollution is a very serious matter now a days as it is highly affecting the normal working of environment and causing various types of harmful effects on the living beings and there functioning. The term pollution is described as "The

presence of very harmful or poisonous substances, which causes ill effect on the environment and its functioning, is known as pollution." (Melissa Mayntz, 2013) The substance which causes pollution is known as pollutants. Pollutants may be anything which has harmful effect on the environment.

Pollution is of several types' likes' water pollution, air pollution, noise pollution, soil pollution etc. There are various sources of air, water and soil pollution but one of the major sources of these types of pollution is lubricants from petroleum based oils due to their poor biodegradability and high toxicity.

Lubricants: Lubricants are the very important substances now days for reducing the wear and tear of machine parts. Lubricants also reduce friction which in turn reduces the loss of heat (Lansdown, 2004). There are various functions of lubricants in different types of industries

like automotive industry, manufacturing industry, marine industry etc.

Lubricants are composed of base fluid and additives, base fluid is the major part of lubricant formulation which is mainly made from petroleum based oils and rest is additives to impart desirable properties. These petroleum based lubricants are poorly biodegradable and have high toxic effect. Spill of these types of lubricants from the working area to the surrounding water or in soil causes very ill effect to the ecological system, which is unacceptable due to rise in environmental concerns. Furthermore these petroleum based lubricants have harmful effects on the operator, lubricants causes various types of skin diseases.

Worldwide consumption of these petroleum based lubricants is more than 41 million tonnes out of which more than 40 % of these lubricants are directly lost in environment through spills and accidents from working machines, which cause very serious damage to the ecosystem (Joaquin J. Salas et al., 2011). Thus a step towards finding an alternative source of petroleum based lubricants is to be taken for controlling the environmental pollution. This can be achieved by utilising the available biomass for producing the alternative lubricants.

Biomass: Biological materials generally plant derived materials are considered as biomass (BEC, 2012). Biomass is renewable source of energy which can be converted into other type of energy sources and can be used as an alternative to conventional energy resource. The thing which gives biomass upper hand over conventional resources is that biomass is available in plenty and also its production is easy.

Biotechnology

Biotechnology is the discipline of biological science through which the biomass is converted or modified to produce useful products (CBD, 2013). Biotechnology involves various types of conversion

process like chemical conversion, thermal conversion and biochemical conversion.

Biotechnology not just only deals with conversion process it also gives opportunity for modifying the existing biomass by chemical treatment (Wagner et al., 2001) and by genetic modification. By different types of modification the useful properties of biomass can be enhanced at utmost.

Alternative resources: Various from of biomass are available in India which can be utilised as alternative resource for producing lubricants. Non edible vegetable oil producing plants are the best alternative resource for producing these types of lubricants. These plants are available throughout the India; these plants are mainly grown for seeds. Oil is extracted from various parts of the plant like leaf, stem, roots but mainly oil is extracted from seeds of the plant. On an average seeds contains about 40 to 60 % of oil which can be used as a base fluid for making lubricant formulations.

Some of the widely available non edible vegetable oils producing plants in India are *Jatropha* (*Jatropha curcas*), *Karanja* (*Pongamia pinnata*), *Mahua* (*Madhuca indica*), *Neem* (*Azadirachta indica*), *Simarouba* (*Simarouba glauca*), *Wild apricot* (*Prunus armeniaca*), *Castor* (*Ricinus Communis* L) etc (Amit Kumar Jain et al., 2012) (NOVODB, 2012). Non edible vegetable oil can also be used as an additive or as a blend with petroleum based lubricants. Lubricants from these types of alternative resources are generally known as biolubricants.

Biolubricants

Biolubricants is a revolutionary step in the world of lubricant. Biolubricants are described in many ways like ecofriendly lubricants, green lubricants, biodegradable lubricants, recyclable, nontoxic and reusable etc.

Biolubricants compared to petroleum based lubricants have very low or no pollution causing effect on environment. Biolubricants also have zero

toxicity, so no skin diseases to the operator in case of leak or accident. Biolubricants are highly biodegradable compared to petroleum based lubricants. Furthermore biolubricants possess almost similar

features like viscosity, lubricity, viscosity index etc (Sevim et al., 2000). Which makes biolubricants a best alternative of petroleum based lubricants.

Table 1. Oil contents of widely available non edible vegetable oils

Non edible vegetable oils	Oil Content by volume
Jatropha	25 - 35 %
Karanja	20 - 25 %
Castor	37.2 - 60.6 %
Mahua	35 - 40 %
Neem	20 - 30 %

Biodegradability is one of the most important property of lubricant; a good lubricant should be highly biodegradable when released in environment. Biodegradability of lubricant is defined as "Susceptibility of a lubricant to degrade under the effect of biological organism like

fungi without causing any diverse effect on environment." (Ioan, 2002) Petroleum based lubricants are poorly biodegradable while the lubricants from alternative resources are highly biodegradable and also not cause any adverse effect on the environment.

Table 2. The biodegradability of petroleum based lubricants and lubricants from alternative resources (Mohanti, 2001)

S.No	Lubricant	Biodegradability (%)
1	Petroleum based lubricants	20 - 30
2	Lubricants from alternative resources	90 - 100

It is clear from the table 2 that lubricants from alternative resources are having much higher biodegradability than lubricants from petroleum based lubricants. Lubricants from alternative resources are having biodegradability in the range of 90 to 100 %, which means that these lubricants quickly degrade in the effect of biological organism. Thus the adverse effects of lubricants caused to the environment are reduced at a greater extent, which is the demand of today's world. Also they found their use in various industrial applications (Erhan et al., 2006).

Environmental Pollution Control

Controlling environmental pollution caused by petroleum based lubricants is of prime importance, as these lubricants having adverse effect on the ecological system and on all the living beings. Comparison of petroleum based lubricants with lubricants from alternative resources is shown in table 3. It is clear from the table that petroleum based lubricants are the main cause of environmental pollution, while the lubricants from alternative resources are best to reduce the environmental pollution and also to reduce the harmful effects on the human being and other living beings.

Alternative resources like non edible vegetable oils can be produced domestically while the petroleum oil cannot be produced domestically and it also on the verge of depletion so as its price is also increasing.

Petroleum based lubricants are dangerous to handle and store in case of spill, leakage etc due to their poor biodegradability and high toxicity while this is not the case with the lubricants from alternative lubricants.

Table 3 Comparison of petroleum based lubricants with lubricants from alternative resources

Environmental Pollution Control			
S.No		Petroleum Based Lubricants	Lubricants from Alternative Resources
1	Biodegradable	No	Yes
2	Toxic	Yes	No
3	Harmful by-products of Emission	Yes	No
4	Cause of Global Warming	Yes	No
5	Highly Toxic to Humans and Animals	Yes	NO
6	Pollutes Environment	Yes	No
7	Economic Gain to Indian farmers	No	Yes
8	Dangerous to Handle and Store	Yes	No
9	Domestic production	No	Yes
10	Alternative Resource	No	Yes

Conclusion

Biotechnology has a vital role to play in reducing the environmental pollution thus utilizing the alternative resources. The adverse effects of petroleum based lubricants on environment and all living beings can be reduced at a greater extent by promoting the biolubricants.

Lubricants from alternative resources control the environmental pollution by preserving ground water and soil, reducing petroleum oil consumption, cost of disposal is reduced, natural recycling of hazardous waste, high flash and fire point reduce risk of fire in case of accident and no skin problem to the operator.

There is a need to take right step in the field of development of lubricants from alternative resources to make it more cheap and easily available, it can be achieved by focussed research through appropriate government policies and regulation for the use of lubricants from alternative resources.

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