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Indigenous Plants Based Biodiesel Resources in Pakistan

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ABSTRACT

Biodiesel is an emerging solution for the present day concerns about rising oil prices and depletion of fossil fuel resources throughout the world. In current scenario due to shortage of energy resources, biodiesel is very good option for energy security in Pakistan. There are large arable lands with good climatic conditions for large biomass production of biodiesel yielding species. In this study data is compiled to identify plant species bearing seeds rich in oil for biodiesel production. Among them the most important are *Pongamia pinnata*, *Brassica* spp. and *Ricinus communis*. Bio fuel reduce dependence on imported petroleum with associated political and economic vulnerability, reduce green house gas emissions and other pollutants, and revitalize the economy by increasing demand and prices for agricultural products. This paper suggests decision makers in government of Pakistan to take initiative to develop project for commercial production of biodiesel by using indigenous plants based resources.

Key Words: Indigenous plants, biodiesel, Pakistan.

INTRODUCTION

Use of biological resources to improve the economy is an old tradition of human history. Plants are the unique biological resources form the basis of life. They provide us with many services, food, medicine, timber, fodder and alternative energy sources in the form of Biodiesel (Hartwell, 1971). Biodiesel is a renewable transport fuel generally extracted from plant seeds or from its other parts i.e. flowers etc. and is used as an alternative of diesel. Biodiesel is the diesel oil which is simple to use, bio degradable, nontoxic and essentially free of sulfur and aromatics. These properties of bio diesel lead to the initiation of work not only in developed but also in under developed countries like Pakistan. Due to the spontaneous use of petroleum products, the prices have reached to their peak level. Thus to overcome these problems, the need for fossil fuel replacement arose and this led to the discovery of biodiesel (Karme and Chadha, 2005).

Pakistan is basically an agriculture country with diverse flora and having number of biodiesel yielding pant species. Moving away from petroleum oil due to shortage of fossil fuels in the World. Pakistan is also committed to promote renewable energy like biofuels. As present energy scenario of the country is concerned, our society use number of sources of energy as cow dung, firewood, coal and petroleum (petrol, diesel, kerosene, lubricating oil and bitumen/tar). Many oil seeds crops are grown in Pakistan as a source of vegetable oils as well as many oil yielding wild plants are found in different areas of the country. Pakistan has a rich biodiversity of natural resources with special reference to oil yielding plants. This diverse nature of flora is due to diverse edaphic and climatic conditions. Basically Pakistan is an agricultural country and resources are enough which can be utilized for production of bio-diesel (Ahmad *et al.*, 2007). Unfortunately, no systematic investigations have been done on bio-diesel technology due to lack of education, confidence and no interactions between our industries and research institutions.

Due to shortage of fossil fuel, it is the need of time to explore alternative sources of energy to meet the energy requirement in the country. Present study is the first reference of plants resources for biodiesel production and application in Pakistan.

MATERIALS AND METHODS

The study was conducted during 2007 in Biodiesel Lab., Department of Plant Sciences, Quaid-i-Azam University Islamabad, Pakistan under the University Industry Technology Support Program ((UITSP) of Higher Education Commission (HEC) Islamabad, Pakistan. Frequent field trips and surveys were conducted to collect seeds of plant species and identify resource based areas. Oil extraction was done in by using Electric Oil Expeller. Crude oil was processed to methylesters (Biodiesel) by using transesterification method (Meher et al., 2006). Fuel properties of biodiesel were tested and compared with high speed diesel (Gerpen et al., 2004); Shaine et al., 2004). Performance trials of biodiesel were carried at the test ground for internal combustion engine in the biodiesel laboratory and road run test was on Toyota (2D).

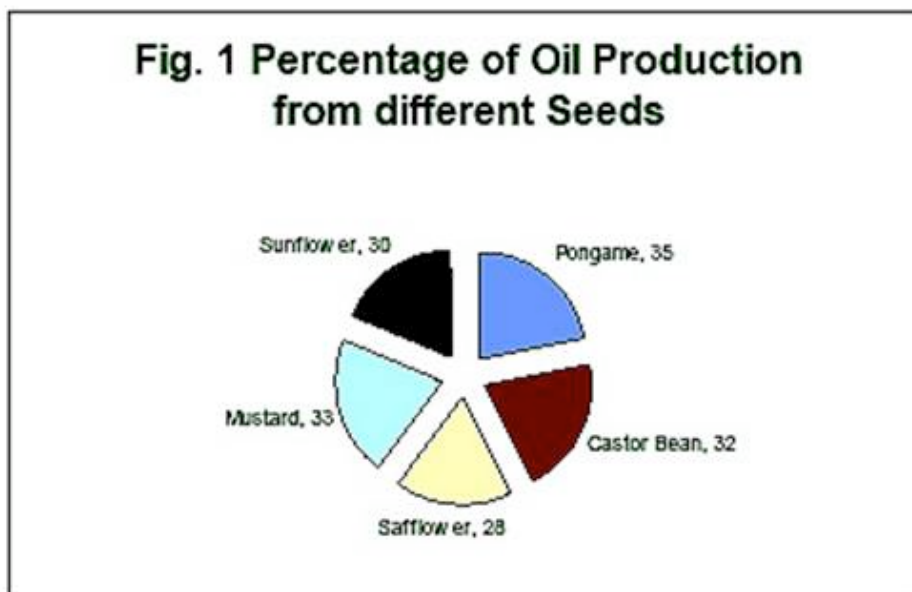
RESULTS

In present study nine (09) plant species were investigated for biodiesel production in Pakistan (Table 1).

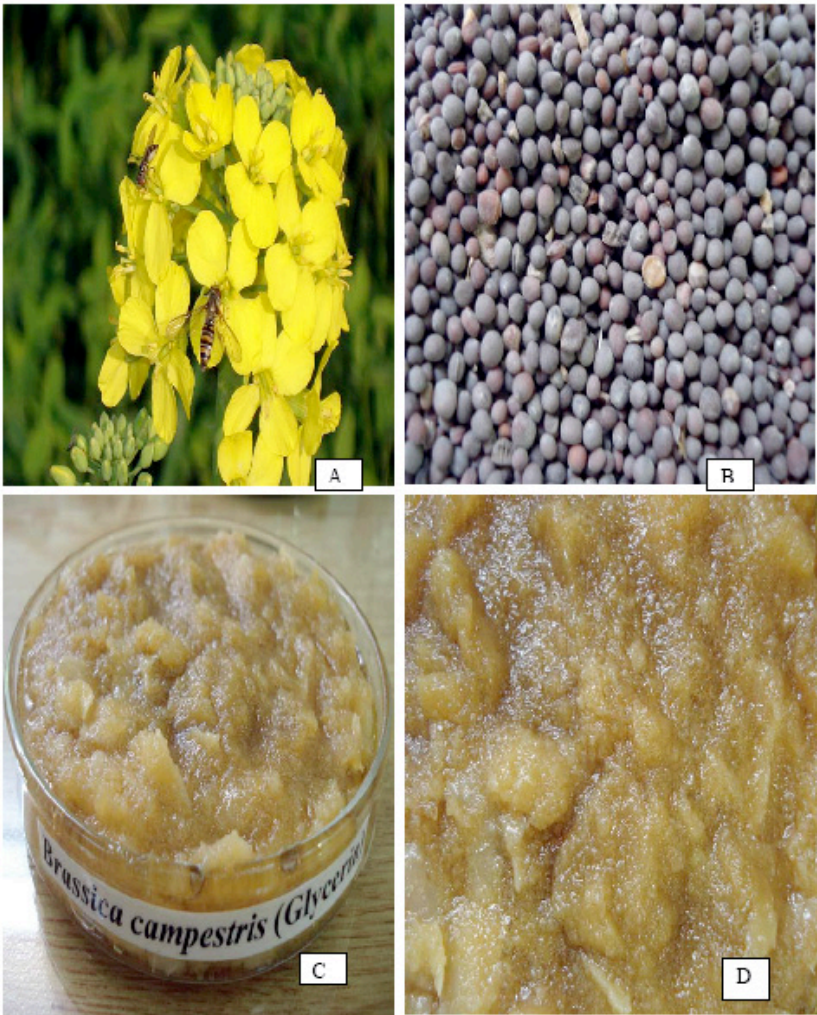
Table 1. Biodiesel producing plant species in Pakistan.

S. #	Botanical Name	English Name	Local Name	Family	Indigenous Uses	Oil Yield %
0 1	<i>Carthamus Tinctorus</i>	Safflower	Kasum	Asteraceae	Jaundice Digestion	28
0 2	<i>Helianthus annuus</i>	Sun Flower	Suraj Mukhi	Asteraceae	Weakness	30
0 3	<i>Brassica campestris</i>	Mustard	Sarson	Brassicaceae	Scabies, breast Tumors	33
0 4	<i>Brassica rapa</i>	Canola	Canola	Brassicaceae	Massage	33
0 5	<i>Ricinus communis</i>	Castor bean	Arind	Euphorbiaceae	Cold, colic convulsions, corns, craw- craw, deafness, delirium, dermatitis	32

06	<i>Pongamia pinnata</i>	Pongame	Suck Chain	Fabaceae	Mouth & gum diseases, skin allergy, mosquito repeller	35
07	<i>Arachis hypogea</i>	Peanut	Mong phalli	Leguminosae	Debility	32
08	<i>Gossypium hirsutum</i>	Cotton	Kappa	Malvaceae	Bronchitis, diarrhea, dysentery, and hemorrhage	30
09	<i>Sesamum indicum</i>	Sesame	Til	Pedaliaceae	Edible, antioxidant, diabetes	31



The data of research work revealed that there are many plant species which have greater oil potential for biodiesel production. In this study it was found that a wild species pongame have high yield of oil (35%) and castor bean (32%). The other plants including rapeseeds have (33%) yield and sunflower has 30% (Fig. 1).



A- Brassica campestris, B- Seeds, C- Glycerin, D- Soap



A- *Brassica campestris* Biodiesel

DISCUSSION

Pakistan must face a new stage in the development of its oil industry. After a decade in which oil reserves have shown a pronounced drop, it has become necessary to find new sources. However, the chances of finding oil wells of considerable size are becoming more and more limited. This situation has made it imperative to take a gamble with smaller oil fields that had once been deemed economically unviable. Biodiesel fuel can be defined as medium length (C16± C18) chains of fatty acids, and is comprised mainly of mono-alkyl fatty acid esters. Biodiesel fuel has the benefits of being non-toxic, biodegradable and essentially free of sulfur and carcinogenic ring components (Yama *eta!.*, 2001). The plants based biodiesels include the palm oil, soybean

oil, sunflower oil, coconut oil, rapeseed oil and tung oil (Ma and Hanna, 1999). Soy biodiesel is predominantly used in the United States, while canola biodiesel is dominant in Europe (Kinast, 2003).

Pakistan with a land area of 79.61 million hector is located at the Western End of South Asian Subcontinent. The wide variation in geography, altitude, soil, climate and culture has created a rich biological diversity of plants and animals. It is estimated that the area contain 6000 species of higher plants (Ahmad et al., 2007). Pakistan is basically an agriculture country which contain Kharif crops (summer) and Rabi (Winter). Number of cereals, legumes, vegetables, sugar crops, fodders, oil seeds and condiments are grown. Among these crops oil seeds have greater economic importance with special reference to edible oil and alternative energy resources i.e. biodiesel. In previous years a lot of work has been conducted on various aspects of plants in Pakistan but no reference exists on utilization of oil seeds for biodiesel application. Keeping in mind the shortage of petroleum products, the present research work was designed to study the biological resources used for biodiesel.

- Due to vast area and varied agro climatic conditions of Pakistan, a land will support the cultivation of these crops. But most of the area in Pakistan is still bare. So it is the need of time to carry out research work and use this present research to develop plant based bio-diesel industry in Pakistan, which will be useful for future prospective and will improve socio-economic conditions of Pakistan.
- In all developed countries, research and development has always played a vital role in profitable development of industry. In developed and some developing countries more and more R & D activities are being sponsored by the private sector and their Governments are assisting them and taking part in these activities by way of tax incentives and award schemes.
- It is also recommended that policies should designed and incentives offered by government to develop biodiesel companies and industries in the country.
- Serious consideration should be given to establish a maga tree plantation for production of oil seeds in biodiesel application.

- It is recommended that production of biodiesel to final use by consumer, quality should be given priority. Number of strategies should be given importance such as collection of seeds, extractions, processing, handling, storage and marketing. Therefore positive inspection system for all these sectors including agriculture, private sector and farming system.
- In view of the present study as presented in this issue about the economic importance of national plants resources used for biodiesel production, research, development and cultivation efforts should be focused on these plants and other identified resources.
- It is proposed to further extend the project of bio-diesel. There is need to establish pilot projects to commercialize bio-diesel and set up its supply chain. The project may be extended step wise like conversion of vehicle fleets of designated departments on bio-diesel.

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