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## Review Article

### Potential Source of Biodiesel - *Pongamia pinnata*: A Review

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Abstract	Keywords
<p><i>Pongamia pinnata</i>, a multipurpose, perennial tree belonging to Leguminaceae family is gaining lot of importance for the production of biodiesel. The botanical description of the tree, its distribution and ecological requirement are briefly discussed in this paper. The detailed information about the uses of the tree is summarized. Overall, this paper gives an overview on covering the biology, and various industrial uses of <i>Pongamia pinnata</i>.</p>	<p>Biodiesel Leguminosae <i>Pongamia pinnata</i></p>

## Introduction

India ranks sixth in terms of energy demand. Its economics is projected to grow at 8-9% over next two decades and its energy demand is accepted to grow at an annual rate of 4-8% over the next couple of decades. So “Energy independence” will be one of the vital areas to make India developed nation. Among the bioenergy, plants role is considered very promising because of its renewable nature and sustained production with low cost maintenance. Biodiesel produced from trees yielding oil is fast emerging as a viable alternative to petro diesel, particularly in the fall of its diminishing supply and resulting steep increase in price because of heavy requirement of edible oil, non edible oil yielding plants and trees are considered ideal for Indian condition for the production of biodiesel, so that the edible oil can be secure for food security. Biodiesel an alternative and renewable source of fuel having low emission profiles

and also environmental beneficial also. The purpose of this review is to provide information about the crop.

## Botanical description

India has many non-edible tree borne oil seed of which *Pongamia pinnata* has a lot of potential. *Pongamia pinnata* locally known as Karanja is an indigenous tree to India. The word *Pongamia* is derived from the Tamil name “Ponga or Pongam”.

Karanja belongs to family Leguminosae sub-family Papilionaceae is a medium sized evergreen or briefly deciduous glabrous tree, 15-25m high, with straight or crooked trunk 50 -80 cm or more diameter and broad crown of spreading or drooping branches. The bark is greyish green or brown, smooth or covered with tubercles, leaves compound, imparipinnate, leaflets opposite, 5-9 in number ovate or elliptic. Flowers white

tinged with pink or violet, fragrant, in axillary racemes pods are compressed woody, elliptic to obliquely oblong pointed at both ends, indehiscent, yellowish gray when ripe, varying in size and shape, 4.0-7.5 cm long and 1.7-3.2 cm broad, seeds usually one, rarely two, elliptical or reniform, 1.7-2.0 cm long and 1.2-1.8 cm broad, wrinkled with reddish brown leathery testa.

### Geographical distribution

It is found almost throughout India up to an altitude of 1200m (Chaturvedi, 1975). It is chiefly found along the bank of stream and river or near sea coast, beach and tidal forest (Troup, 1921). It is widely grown from tropical dry to subtropical dry forest. It is shade bearer and is considered to be good tree for planting in pastures, as grasses grow well in its shade. The tree is suitable for afforestation especially in watershed areas and drier parts of country. Andhra Pradesh, Harayana, Karnataka, Madhya Pradesh, Odisha, Rajasthan, Tamil Nadu and Uttar Pradesh are the potential states in the country. Large numbers of karanja trees have also been planted in roadside both in highways and also in urban area during last two decades.

Karanja is a widely adaptable tree that grows under a wide range of climatic and soil conditions. The area having temperatures ranges from 5<sup>o</sup>C to 50<sup>o</sup>C and with well distributed annual rainfall of 600-2500mm is suitable for its growth. The tree can grow even in dry area with poor, marginal sandy and rocky soils. However it does not like very dry sandy or very wet clay soils but flourishes best in deep sandy loams with abundant moistures which is most suitable for its growth. Besides drought tolerant it is also tolerant to saline conditions.

### Multipurpose uses of *Pongamia pinnata*

The tree starts bearing at an age of five to seven years. The fruiting season is extended in general from November-December to May-June. The pods are collected and the shells are removed by hand. The yield of fruits varies from 9 to 90 kg per tree for different age trees (CSIR, 1966). The oil yield is reported to be about 32 %, 24 to 26.5 percent if mechanical expellers are used for the recovery of oil from kernels but it is only

18-22 percent from village crushers. The oil can be used for the production of biodiesel because of its favourable physiochemical properties. It has no polyaromatic compound reduced toxic smoke and soot emission. The fresh extracted crude oil is yellowish red/ brown and it get darkened during the storage. The oil is having disagreeable odour and bitter taste. The solvent extraction method gives good quality oil than ordinary extraction methods. The iodine value is a measurement of the unsaturation of fats and oils. Higher iodine value indicated that higher unsaturation of fats and oils (Bobade *et.al.* 2012). The tree borne oil can be directly mixed with diesel fuel and may be used for running an engine. The blending of vegetable oil with diesel fuel in different proportion were experimented successfully by various researchers. Blend of 20% oil and 80% diesel have shown same results as diesel and also properties of the blend is almost close to diesel (Channapattana *et al.*, 2009).

### Taxonomic position of *Pongamia pinnata*

Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Fabales
Family	Leguminaceae
Botanical Name	<i>Pongamia pinnata</i>
Common Name	Karanja, Pongam

Besides its use for production of bio-diesel the oil is also used for tanning leather, soap, as illuminating oil and for lubrication. The oil cake is used as pollutary feed (Mandal *et al.*, 1982). The oil is also used for curing rheumatism, Powdered seed is used as febrifuge, tonic and for curing bronchitis and whooping cough. Flowers are used for diabetics (Hewamanna *et al.*, 2004) and bark for internal bleeding piles, diarrhoea and curing beriberi.

### Conclusion

The *Pongamia pinnata* industry is at a very early stage of development. There are areas in the world where interest in the plant product was high, a lot of research has been going on biodiesel derived from it. *Pongamia pinnata* is one among many oil seeds that can be used to

produce biodiesel, soap and poultry feed. Currently, growers are unable to achieve the optimum economic benefits from the tree, especially for its various uses. The markets of different products from this species have not been properly explored or quantified. It helps in meeting some of the needs for energy services for rural communities and also creating avenues for greater employment.

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