

Jatropha curcas Linn

a.k.a

Jarak Pagar, Jarak Putih, Physic Nut



BIODIESEL B-10 , B-20 , B-30

JATROPHA AS A BIOFUEL

Indonesia is no longer a member of OPEC – Oil Producing Exporting Countries. To supplement and minimise the import requirements of fuel oil, and to support the move towards renewable energy, the Indonesian Government has mandated a requirement to use **Biodiesel** instead of pure diesel (solar) in all diesel engines,

What is BioDiesel?

Biodiesel is an alternative fuel with similar properties to conventional or “fossil” petro diesel (solar). Biodiesel is a Fatty Acid Methyl Ester (**FAME**) or Fatty Acid Ethyl Ester, commonly used as a type of biofuel. It is derived from organic fats and oils that have reacted with alcohol (via transesterification) to form a liquid ester. This can be used 100% pure or easily blended in any ratio with petro diesel and used to power diesel engines. FAME is also used in some human foods. The Indonesian Government initially stipulated the requirement to use B-10 Biodiesel – a mixture of 90% diesel (solar) and 10% biodiesel fuel, then it increased the blend to B-20 (20% biodiesel), and most recently, is now promoting B-30 – a 30% biodiesel mixture of biofuel for the year 2020.

Biodiesel can be produced from straight vegetable oil, animal oil/fats, animal tallow and waste cooking oil.

So, what is Biofuel?

Biofuel is a fuel that is produced through contemporary biological processes, such as agriculture and anaerobic digestion, rather than a fuel produced by geological processes involved in the formation of fossil fuels, such as coal and petroleum, from ancient biological matter.

How does Biofuel differ from Biomass?

Biomass refers to plants or plant-based materials that are not used for food or feed and are specifically called lignocellulosic **biomass**. As an energy source, **biomass** can either be used directly via combustion to produce heat, or indirectly after converting it to various forms of biofuel.

The process used to convert these oils to **Biodiesel** is called transesterification as referred to above. Most of the world’s production of biodiesel has been sourced from edible oil seeds.

CPO - Crude Palm Oil is used extensively. This, of course, is not sustainable and increasingly not economically feasible; therefore, the use of non-food oil for biodiesel feedstock needs to be developed. *Jatropha curcas* Linn is one possible and very suitable alternative.

What is *Jatropha curcas* Linn?

Jatropha curcas Linn, or Jarak Pagar as it is called in Indonesia, is a small bush or plant of the Euphorbiaceae family. It is cultivated to grow to a maximum height of 2 meters and has irregular branches.

The seedling is transplanted from the nursery after a growth period of about three months. With proper due care the plant may be harvested after 9-12 months and it reaches maturity after three years and the plant has a commercial life of 30-35 years. It is a hardy plant, which can be grown in marginal land and hence does not threaten food production and or the destruction of tracts of rain forests. An additional benefit for planting of *Jatropha* in remote areas of Indonesia is that the cultivation and collection of the *Jatropha* seed will provide employment to substantial numbers of people in poverty-prone areas.

Oil is extracted from the seed by crushing and the oil is then filtered to become **Crude *Jatropha* Oil (CJO)** while the residue from the seed is processed into either biomass or fertiliser.

INDONESIAN'S ROADMAP FOR BIOFUEL DEVELOPMENT

Biodiesel

Year 2005-2010

Biodiesel Utilization 10% of Diesel Fuel Consumption 2.41 million kL

2011-2015

Biodiesel Utilization 15% of Diesel Fuel Consumption 4.52 million kL

2016-2025

Biodiesel Utilization 20% of Diesel Fuel Consumption 10.22 million kL

Currently the Indonesian Government has stipulated all diesel engines must use B20 (20% Biodiesel-80% Diesel mixture)



Jatropha Plantation, West Java



Jatropha Fruit



Jatropha Seed

Crude Jatropha Oil is a non-edible non-food oil.

The seeds contain oil that can be processed to produce high quality Crude Jatropha Oil (CJO).

Biofuel from Crude Jatropha Oil (CJO) has been tested and approved for use in diesel engines in vehicles, electrical power generators, marine engines and as Bio-Synthetic Paraffinic Kerosene (Bio-SPK) for aircraft fuel.

The CJO has been processed into Bio-SPK and was successfully tested by Air New Zealand and Boeing on a 3-hour test flight in 4 Boeing 747 engines in 2008.

Scientific findings released by Air NZ following the test flight which utilised a 48% blend of Jatropha oil and traditional jet fuel, showed a 60 to 65 percent reduction in GHG emissions.



The residue Seedcake that remains after extracting oil has a good calorific value and can be used a biomass feedstock for boilers to power steam generators to produce electricity and it can also be processed to use as fertiliser or cattle fodder.



The development of the *Jatropha curcas* plant is most suitable on arid land which is classified as S3 in Indonesia. According to the Indonesian Government they have in excess of twenty-nine million hectares of S3 land suitable for the cultivation of *Jatropha curcas* Linn. *Jatropha curcas* Linn is a perennial crop which can withstand drought. This plant can grow fast and strong in dry weather, critical land and even rocky ground.



One hectare of Jatropha plants will reduce 20 tons per year of carbon dioxide for up to 30 years.

An extract from the poisonous shrub Jatropha curcas acts as a strong painkiller and may have a mode of action different from conventional analgesics, such as morphine and other pharmaceuticals

In the mid-2000s, especially during the year 2007/2008, there was widespread interest in developing biodiesel based on a little-known crop species, Jatropha curcas Linn (Jarak Pagar).

Jatropha was promoted as “**Green Gold**”, a perfect solution for biofuel.

CJO is biodegradable in seawater.

By-Products from Jatropha.

Fruit: Fertiliser,

Leaves: Medical use, Silkworm food,

Latex: Wound healing, Medical uses

Seeds: Insecticides, Biomass.

Fruit Hulls: Biomass, Activated Carbon, Organic Fertiliser.

Oil: Biofuel, Soap, Candles, Lubricants, Medical uses.

Seed Cake: Biogas Production, Organic Fertiliser, Cattle Fodder.

Seed Shell: Biomass, Organic Fertiliser, Activated Carbon, Particle Board.

Pruning: Biomass.

Traditional Medicine

***Jatropha curcas* Linn** is known for various medicinal uses in Indonesia.

Its antimicrobial, anti-cancer and anti-HIV activity has been well recognized.

Plants have a long evolutionary history of developing resistance against viruses and have increasingly drawn attention as potential sources of antiviral drugs. *Jatropha curcas* belongs to the family *Euphorbiaceae*, which is known for various medicinal uses.

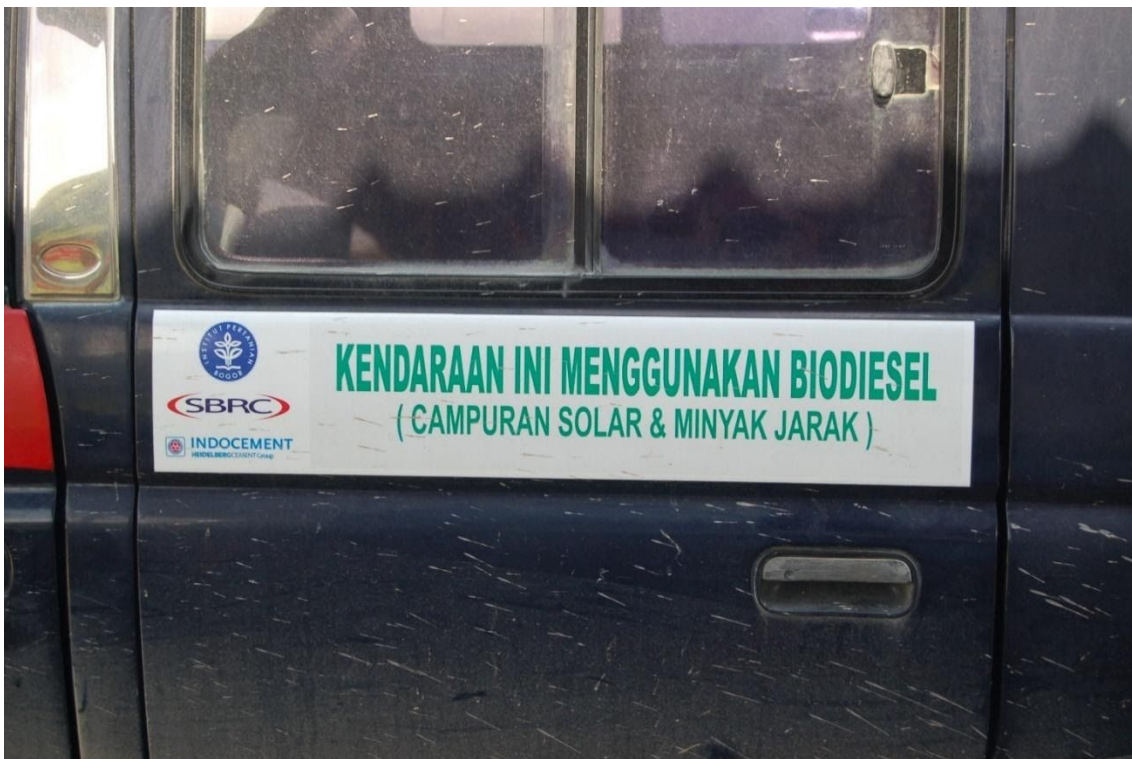
Preparations of all parts of the plant, including seeds, leaves and bark are used in traditional medicine and for veterinary purposes. The oil has a strong purgative action and is also widely used for skin diseases and to soothe pain such as that caused by rheumatism. A decoction of leaves is used against cough and as an antiseptic after birth.

The latex of *Jatropha* contains an alkaloid known as “Jatrophine” which is believed to have anti-cancer properties.

Many scientific studies have attributed *Jatropha curcas*'s potential to cure numerous diseases and illnesses to the vital phytochemicals in the plant like saponins, steroids, apigenin, tannins, alkaloids and flavonoids among others. These chemicals make *Jatropha curcas* a very versatile plant with numerous uses that has made it gain admiration from several communities across Indonesia and other parts of the world.

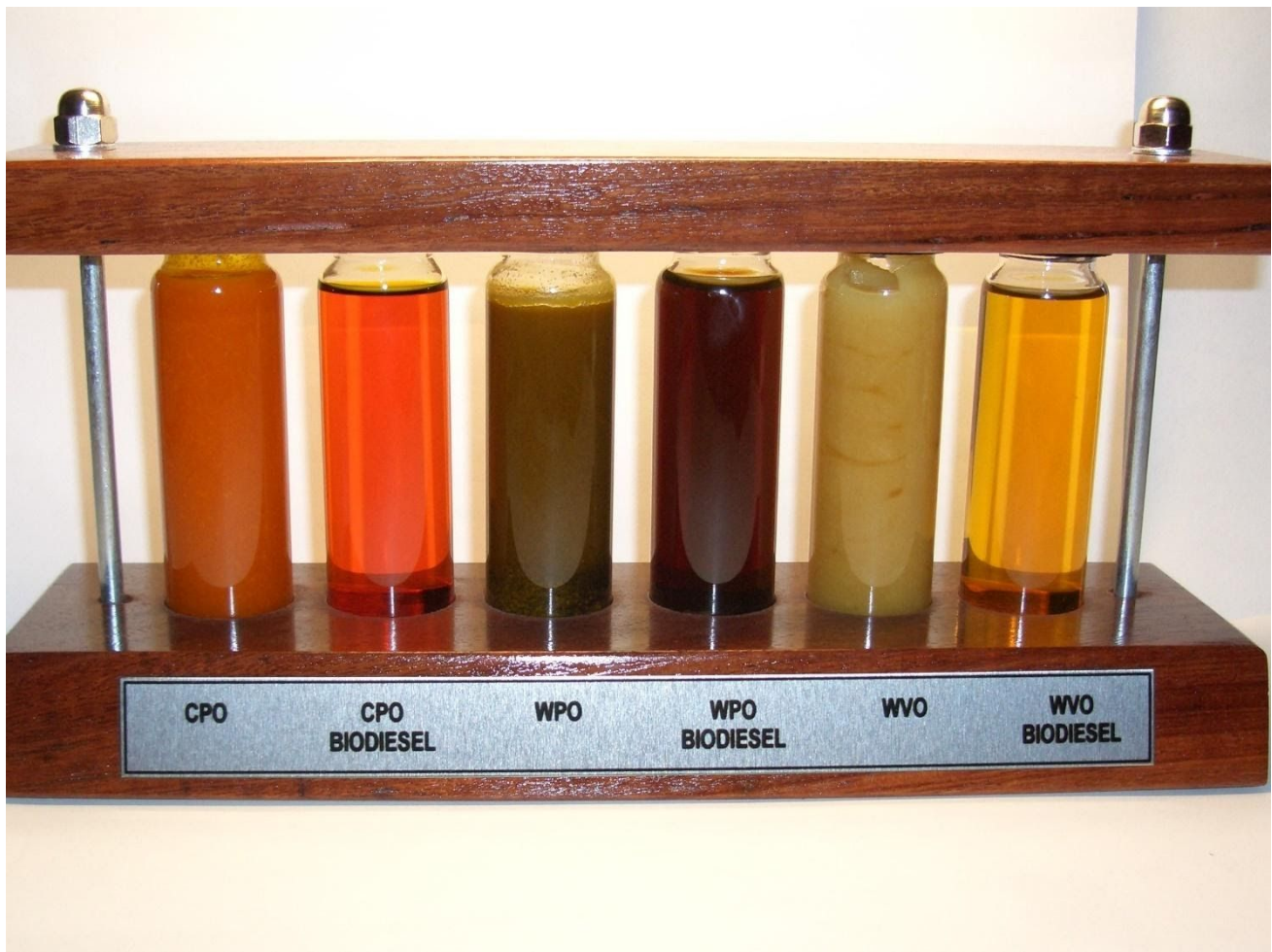
BIOFUEL ROAD TRIAL

In July 2006, the Indonesian Government ran a very successful trial using CJO as Biofuel in two Nissan Navara vehicles travelling from Atambua, Kabupaten Belu, NTT, to Jakarta.



BIODIESEL

Biodiesel is an alternative fuel similar to the fuel properties of conventional or 'fossil' diesel. It produces similar power, significantly reduces exhaust smoke, has no toxic emissions and increases the lubrication properties of diesel resulting in less wear and quieter engine noise.



CPO Crude Palm Oil - WPO Waste Palm Oil -WVO Waste Vegetable Oil



Biodiesel Production Unit

A commercial unit has the same small footprint as shown in above module as a sequential batch system. The Hydraulic Power Pack is similarly remote with the commercial unit as a safety measure in the presence of methanol. All up with Methanol and reagent containers the footprint would be approximately 8 x 5 metres.

It can produce 5,000,000 to 10,000,000 litres a year of B100 on a two-shift basis over 200 or 300 days. It weighs 2.5 ton, is easily operated with a two-man crew and operates at ambient pressure at 60°C.

Production rates of the standard 650 litre reactor.

For good quality 500 litres of oil per batch, conservatively 1,000 litres per hour x 8 hours 8,000 litres per shift of B100.

Operating 24 hours per day (2,400 litres) over 300 days **7,200,000 biodiesel litres per annum.**

These units are fully transportable and can be easily added to as modular units to any production level required

The machine operates at just over 60 degrees C and at atmospheric pressures. Standard industry training and safety protocols for chemical processing apply.

It will also produce 20% by volume of glycerol as a byproduct that can be used for soap, soil additives etc.

The feedstock oil, alcohol, biodiesel and glycerol that readily drops out of the biodiesel by gravity all require tanks for storage.

This modular unit can be made available to investors in Indonesia later in 2019.



Transportable in sea containers or truck trays.

Biodiesel is a clean burning, fully biodegradable, non-toxic and Sulphur-free biofuel. It contains no petroleum products apart from the chemically bonded alcohol to oil to form the alkyl ester.

The alcohol reactant used can be organic ethanol made from sugars, methanol from wood or derived from petroleum as a by-product. Biodiesel can be blended with any level of petro diesel to create a blend and can be used in fixed diesel engines generally without modification. Older style rubber hoses and seals in some older engines can soften from high ratio biodiesel (B80 to B100) but modern engine hoses and seals are unaffected. The viscosity of biodiesel is usually higher than petro diesel and if used in common rail high injector pressure diesel engines it is blended with diesel. Non common rail engines can use B100. Mild preheating of the biodiesel can be used to reduce viscosity further but in warm climates it generally operates well regardless of preheating.

FAME is largely preferred over conventional diesel on account of its properties such as no toxic emissions. These above-mentioned properties and fuel applications are anticipated to be key factors driving the global market growth.

FAME is also widely used in food industry as a thickening and emulsifying agent. Spillages are far less damaging to water ways, land and marine environments.

Our successfully tested feedstock oils and fats have included:

- ✓ Crude Palm Oil waste from mill waste ponds (very high free fatty acid levels)
- ✓ Palm oils
- ✓ Palm kernel oil
- ✓ Chicken fats
- ✓ Waste Vegetable oils
- ✓ Canola oil
- ✓ Coconut oil
- ✓ Abattoir tallow
- ✓ Grease trap waste fats (very high free fatty acid levels)
- ✓ Jatropha Curcas Oil (CJO)
- ✓ Waste fish oil
- ✓ Virtually any natural waste oil or fat is fully useable

VARIOUS FEEDSTOCK

OSTRICH TALLOW

FFA – 0.9%

Feedstock Product

Biodiesel



REFINED PALM OIL

FFA – 1.9%

Feedstock Product

Biodiesel



WASTE COOKING OIL

FFA – 2.2%

Feedstock Product

Biodiesel



ABATTOIR TALLOW

FFA – 3.9%

Feedstock Product

Biodiesel

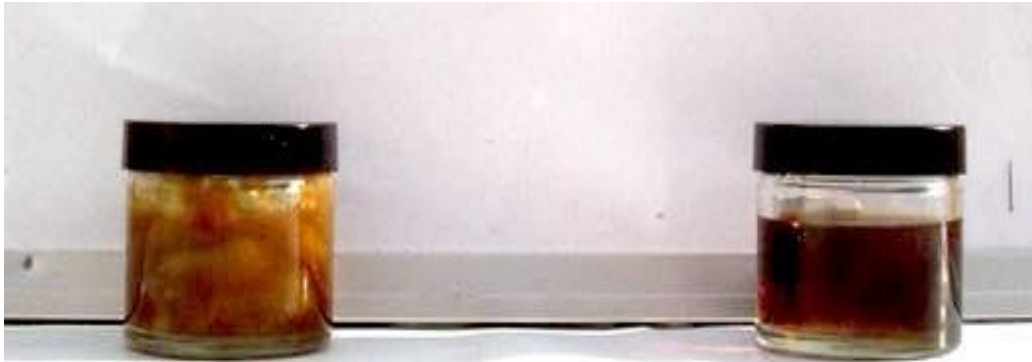


GREASE TRAP WASTE

FFA – 92.2%

Feedstock Product

Biodiesel



PALM OIL WASTE

FFA – 94.7%

Feedstock Product

Biodiesel



The planting, cultivation, harvesting and processing to *Jatropha curcas* Linn (Jarak Pagar) and the production of Crude *Jatropha* Oil will create employment for local Indonesian communities and help to alleviate poverty.



HELP ERADICATE POVERTY

For further details please contact Kevin A. Parker. Email kevin_parker@biodieselind.com
Kevin_parker@cbn.net.id