Pranajiwa as Raw Material for Bio-Oil

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Abstract

The high increase in the number of human population every year causes the increase of human need for energy. However, it unfortunately still does not meet the production of energy sources.. This situation forces us to seek new sources of energies which are certainly eco-friendly, such as utilization of natural resources for biofuels. One of altenative solution is the use of Pranajiwa plants as a source for production of bio-oil. Pranajiwa or Pranajiwa (*Sterculia foetida* L.) is one species of plants in Indonesia originally from East Africa, Tropical Asia and Australia. This kind of tree crops with a kind of tall trees between 30-40 m, the tree is often found in forest. Pranajiwa seeds contain vegetable oils that can be used as an ingredient for industrial products such as cosmetics, soaps, shampoos, fabric softeners, paints, plastics and as an adaptive agent biodiesel. Pranajiwa seeds contain vegetable oils comprising a fatty acid that is sterculat acid. This plant has several advantages over other alternative crops as sources for oil production. Pranajiwa plants is not used for consumption that is dfferent from oil palm, sugarcane, coconuts, yams or cassava that has a primary function for consumption. Pranajiwa plants had fairly high oil yield that was greater than 40%. Event from a research conducted with the purification using ether, the yield of oil could reach more than 70%. Whereas using direct processing, the average oil yield rearched 45%. For biofuels, Pranajiwa seeds can then be extracted and used as raw material of bio-oil.

Keywords: Pranajiwa, bio-oil, alternative energy

Introduction

Increase in population leds to the increase of human need for energy. The energy currently comes from fossil and no longer it will run out. This situation encourages the Indonesian nation to immediately provide and build a populist-based alternative energy that is environmentally friendly by utilizing natural resources and existing plants as a source of energy that can be harnessed and developed. One form of energy is Biofuel (BBN).

Some plants such as jatropha, sweet potatoes, cassava, sugarcane, oil palm, coconut, sunflower, kapok, and pranajiwa or commonly known as a plant "Pranajiwa" can be developed as a biofuel or biofuel farming and to support energy programs or green energy. , The crop plant "Pranajiwa" *(Sterculia foetida* Linn.) is considered more appropriate to be used as Biofuel (BBN) or biofuels, especially as the bio-oil (lubricating oil) and bio-diesel (diesel substitute). This is supported by the fatty acid content which can be also used as an adaptive biodiesel.

However, the existence of plants "Pranajiwa" is now rarely found, even the presence status of plants "Pranajiwa" included a rare (Yuniastuti, 2008). This is partly because these plants have growing requirements at altitude less than 500 m above sea level, and exacerbated by logging and illegal use of timber for furniture materials or raw materials made of paper without rejuvenation. The remaining plants are only in sacred places because people are afraid to cut them down. Cultivation of crops "Pranajiwa" is very little or not at all and eventually the plant is just a legacy from ancestors that will be extinct. In this condition, it is necessary to give serious attention for "Pranajiwa" that has a potential as a producer of alternative energy (bio-oil). Cultivation "Pranajiwa" can be either generative or vegetative.

Pranajiwa *(Sterculia foetida)* is a kind of tree crops with high stature plants between 30-40 m, the tree is often found in the woods. Nomenclature is taken from the Roman myth, the name of god or *Sterquilinus Sterculius fertilizer.* Together with the species name, *foetida* (meaning, hard-smelling, foul) scientific name refers to the unpleasant odor released by these trees, especially flowers. In some areas in Indonesia, this plant is also used as a drug. Plant leaves can be used as an herbal remedy laxative, diuretic and mosquito deterrent; bark as a cure of some diseases; tree wood can be used as building construction; other than edible seeds can also be used as a cough medicine (Yuniastuti, 2010). Pranajiwa oil benefits directly related to the fatty acid content sterculat which is unsaturated fats in seeds (Anggraeni, 2005)

Pranajiwa as an alternative energy-producing plant has several advantages over other alternative energy crops, such as oil palm, sugarcane, coconuts, yams, and cassava. Pranajiwa is not a crop for consumptions; while oil palm, sugarcane, coconuts, yams or cassava has the primary function for consumption. Also compared to other alternative energy crops, Pranajiwa has high oil yield that is greater than 40%, even from research conducted by refining petroleum ether the yield can reach more than 70%. While using direct processing (compound) average oil yield reached 45%. As Fuel Plant (BBN), plant seeds and billowing retrieved and extracted can then be used as raw material for lubricating oils (bio-oil) (Yuniastuti, 2010).

Materials and Method

Locations of research

Research locations were in 10 districts in Central Java, namely:

1. Karanganyar District: Karangmojo, Karangwuni, Derman, Ngaliyan1, Bibis, Kodokan, Teak, Ngaliyan 2, Ngetal, Jetak
2. Sukoharjo District: Shower, Cangkol, Macanan, Temulus, Pondok 1, Pondok 2, Minggiran, Nderso, Palur, Triyagan.
3. Boyolali District: Tegalmuncar, Klabang, Kendal big, Tlatar, Jagoan, Tagung, Badan, Gatak Malangan, Pojok, Bulu
4. Purworejo District: Kroyo, Trukan, Doplang, Sindurjan, Tegal Kuning, Pogung Juru Tengah, Borowetan, Bedug, Paduroso, Bayan
5. Wonogiri District: Krisak, Bulak, Godean, Donorejo, Kaloran, Nambangan, Gerdu, Brajan, Gebang Wetan, Mblimbing
6. Klaten District: Kurung, Kalikebo, Jetis, Talang, Jerukan 1, Jerukan 2, Kebon, Sabrang, Pandanrejo, Planggu.
7. Sragen District: Plalar, Toyogo, Bero, Pengkol, Sambung Macan, Mojopahit, Pucang, Drojo, Tunjung Semi, Demakan.
8. Grobogan District: Gendingan, Tambirejo, Nambuhan, Bakalan, Candisari, Kepayu, Penawangan, Getasrejo, Kronggen, Rejosari.
9. Blora District: Brengus, Dlongos, Keboan, Gagakan, Pudak, Loworejo, Jambangan, Putat, Sukorame, Sambiroto
10. Semarang District: Ngener, Mbatan Kidul, Tawang, Reksosari, Muncar Jaten, Mrakas, Durenan, Sambiroto, Dadapayam

Analysis of Morphology, Cytology and Molecular conducted at the Central Laboratory of the Sebelas Maret University, Laboratory of Plant Breeding, Physiology and Biotechnology Faculty of Agriculture, Sebelas Maret University, Surakarta.

Plant materials

Plant materials used in this study were Pranajiwa or billowing plants *(Sterculia foetida Linn.)* existing in the region of Central Java which covers 10 districts of Sragen, Boyolali, Klaten, Wonogiri, Sukoharjo, Karanganyar, Semarang, Purworejo, Grobogan and Blora.

Activities of the experiment included:

1. Identification of Morphology
2. Cytology
3. Analysis of Chemical Components
4. Seeding and In Vitro Plant Propagation Pranajiwa *(Sterculia foetida* Linn)

Results and Discussion

In the habitus of the plants, grendruwo is a tree with height reaching 45 meters. Plant leaves of "Pranajiwa" grow at the end of branches, is compound leaves, and palmatus shaped leaves with 7-8 children (foliolum). unfoliolatus-shaped leaves, long strands of leaves (laminae) between 10-17 cm with a smooth leaf surface. Flower crop "Pranajiwa" grow at the end of branches and branching to form clumps, and yellow to purplish red. Flower is unisexual with diameters

ranged between 2 – 2.5 cm. "Pranajiwa" Fruits are large enough with a length of about 10 cm, oval-shaped, smooth and woody rind. Seeds of black fruit have a length of between 1.5 to 2.0 cm. "Pranajiwa" fruits are green when still young, then become red and brown when old and will fall to ground. "Pranajiwa" fruits are also unique and strange that are comprised of five lumps (locus), quite large, weighing 1-3 kg that further strengthens the community,s assumption that the fruit is a fruit of "Pranajiwa" (devil fruit). The seeds of "Pranajiwa" fruits will fall and not be utilized optimally because many people are afraid to use it because of the above reason.

Ecologically, the "Pranajiwa" plants serve as a micro-habitat of animals and certain animals. It is reported in Komodo Island the population of yellow-crested parrot *(Cacatua subphurea parvula)* are protected and use “Pranajiwa” trees as a nest. "Pranajiwa" plants have crowns and roots that are fairly large and it can function as a regulator of the hydrological cycle because the roots can hold soil water in a large enough capacity. Internally the "Pranajiwa" plants are difficult to breed through generative ways because its seeds have thick-though skin and dormancy (Sutopo, 2002). However, in plant nurseries soaking in warm water (temperature $\pm$ 45 °C) for 50-10 hours could help to break seed dormancy (Yuniastuti, 2008). "Pranajiwa" seeds soften the harsh experience, and can germinate 3 days after planting. In addition to the generative seed, multiplication can also made through *in vitro* approaches. This is done as a form of plant germplasm conservation of “Pranajiwa”. To overcome Pranajiwa from extinction, conservation efforts should be done through both in-situ and ex situ approaches.

Morphological identification of ”Pranajiwa” plants that were found in Central Java could be classified into two types, namely large fruit and fruit respectively. Grouping of seeds was based on the average weight of 10 seed parents between 1.5 to 2.0 grams (large seeds) and 1.0 to 1.5 grams (small seeds). From the observation, the flowers appeared on the last branch or subsidiary to the 4th to the 6th. Similarly, the leaves, which also appeared in young leaves of the branch to the 4th to the 6th. It was found that the percentage of fruit-set was quite low where in a flower stalk that contains 20-30 flowers is only 1-2 pieces standing. In some areas the observations that had been previously done for such research in Navan this plant was not found, it relates to altitude of the location that is less than in accordance with the terms of Pranajiwa crops to grow. Pranajiwa grow best at altitudes of less than 500 m above sea level. Meanwhile, in some locations of Semarang regency Pranajiwa also have not been found anymore because it was felled and no effort for the rejuvenation of this plant has been done.

Observations in some locations in Blora and Grobogan District Pranajiwa plants have been started to be used for reboitation by the District Government and Blora through the Grobogan Department of Public Works (MPW) by planting plants on the curb and the edge of the irrigation channels.

In May to July pranajiwa plants begin to form flowers and young fruits become old fruit, which is ready for harvesting. In general, pranajiwa plants flowering and fruiting are throughout the year. This situation allows pranajiwa plants to be intensively cultivated and used as biofuel feedstock (bio-oil).

Observation of pranajiwa chromosome number indicated that the number of chromosomes is 2n = pranajiwa 2X = 32. This number gives the assurance that the number of pra najiwachromosomes is 32 not 40. The number of chromosomes is reinforced by images of cells of different pranajiwa (Setyawan, 2009) The previous opinion that pranajiwa chromosome number was 40 may be due to that the number of chromosomes of the genus *Sterculia* is 40 (six of nine species of the genus *Sterculia* species that have been identified and has a number of chromosome 40 is *S. acerifolia* A. Cunn., *S.* A. St *Chicha* .- Hil., *S. rubiginosa* Vent., *S. striata* A. St .- Hil., *S. urens* Roxb., and *S. villosa* Roxb.). another reason is that the method used by previous researchers was less precise that might cause a low quality of the picture of chromosome (eg cell rupture that resulted in the chromosomes of neighboring cells join counted that made the chromosome number increased).

Karyotype was based on chromosome length, and shape of chromosomes. Based on the similarity of the size and shape of chromosomes could be seen that pranajiwa chromosomes are diploid. Based on the size and curve of the centromere is known that each pair of chromosomes pranajiwa is two. This is supported by the similarity of the size and shape of a sorted chromosomes that are homologues of each chromosome.

Standard chemical analysis consisting of analysis of terpenoid compounds, flavonoids, and steroids showed a very low content even not exist at all. Further analysis for tannins, saponins and alkaloids also showed a very low content. This could facilitate the purification pranajiwa seed oil as

a lubricating oil feedstock (bio-oil). Common proximate analysis consisted of water, fat content, protein, carbohydrate, ash, and others.

To determine the amount of oil content (yield results) seeds was carried by two methods that are compress (compound) and of purification with ether methods. On purification with ether, oil content (yield results) was obtained nearly 70%. While the direct compression method yield the results was obtained about 40%. High oil yield from pranajiwa seeds indicate a huge potential for further development as a lubricating oil (bio-oil).

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