Kualitas biodiesel Biji Kepuh (*Sterculia foetida*) dari Berbagai Tempat Tumbuh untuk Mendukung Pengembangan Energi Terbarukan di Indonesia

Caesar Kartika Yoga[1)], Sigit Sunarta[2)], Widiyatno[2)]

INTISARI

Biodiesel merupakan bahan bakar terbarukan dan ramah lingkungan yang dihasilkan oleh reaksi kimia minyak dengan alkohol serta katalis. Kepuh (*Sterculia foetida*) merupakan tanaman alternatif pengganti kelapa sawit yang dapat dimanfaatkan sebagai bahan baku pembuatan biodiesel. Kepuh ditemukan banyak tersebar di berbagai tempat tumbuh di Pulau Jawa. Penelitian tentang karakteristik biodiesel kepuh dari berbagai tempat tumbuh belum banyak diteliti. Penelitian ini bertujuan untuk mengetahui kualitas biodiesel dari berbagai tempat tumbuh, korelasi dengan kondisi geografis, dan mengelompokkan berdasarkan kualitas biodiesel.

Biji kepuh dikumpulkan dari 30 lokasi yang tersebar di Pulau Jawa dengan metode *purposive sampling*. Biodiesel dibuat melalui transesterifikasi dari minyak biji kepuh yang diekstrak menggunakan alat kempa panas tipe sekrup. Proses transesterifikasi dilakukan pada suhu 60^{o}C, katalis KOH 1%, dan kecepatan pengadukan 1200 rpm selama 1 jam. Pengujian kuantitas biodiesel yaitu rendemen dan pengujian kualitas biodiesel meliputi massa jenis, viskositas kinematik, angka asam, angka penyabunan, angka iodium, angka setana, gliserol total, gliserol bebas, kadar metil ester, monogliserida, kadar abu tersulfatkan, fosfor, titik kabut, dan titik nyala. Komponen kimia diidentifikasi menggunakan GC-MS metode derivatisasi asam lemak. Data sekunder berupa garis bujur, garis lintang, ketinggian, rerata curah hujan tahunan (MAR), rerata kelembaban tahunan (MAH), rerata penyinaran matahari tahunan (MAS), dan rerata temperatur tahunan (MAT). Hubungan antara tempat tumbuh dengan kualitas biodiesel menggunakan korelasi Pearson. Pengelompokkan kualitas biodiesel dilakukan dengan analisis kluster metode Ward.

Hasil pengujian rendemen biodiesel dihitung dari minyak kepuh berkisar antara 78,81–86,59%. Kualitas biodiesel yang dihasilkan yaitu massa jenis (836,3–889,7 kg/m^3), viskositas kinematik (2,58–4,53 cSt), angka asam (0,04–0,5 mg-KOH/g), angka penyabunan (189,47–253,27 mg-KOH/g) angka iodium (59,71–11,04 g-I_2/100g) angka setana (46,47–60,31), gliserol total (0,013–0,052%), gliserol bebas (0,008–0,025%) kadar metil ester (99,28–99,79%), monogliserida (0,46–0,83%), kadar abu tersulfatkan (0,003–0,057%), fosfor (0,73–3,81 mg/kg), titik kabut (-4–12^{o}C), dan titik nyala (115–229^{o}C). Hasil GC-MS menunjukkan kandungan ester asam lemak utama yaitu asam sterkulat (57,5–69,16%) sebagai senyawa tertinggi, disusul asam palmitat (11,95–18,81%), asam linoleat (4,47–9,52%), asam oleat (3,96–7,12%), dan asam 10-oktadesinoat (2,3–5,81%). Biodiesel kepuh yang diuji dikelompokkan menjadi 3 kelompok. Klaster 1 menunjukkan hasil terbaik dengan rendemen dan angka setana yang tinggi serta titik kabut rendah sedangkan kluster 2 dan 3 kurang memenuhi standar sebagai bahan baku produksi biodiesel. Hubungan antara kualitas biodiesel dan faktor lingkungan menunjukkan garis bujur, garis lintang, ketinggian, MAR, MAH, dan MAS mempengaruhi kualitas biodiesel kepuh.

Kata kunci : energi, biodiesel, biji kepuh, letak geografis

[1] Mahasiswa Magister Ilmu Kehutanan, Universitas Gadjah Mada
[2] Dosen Fakultas Kehutanan, Universitas Gadjah Mada

Quality of Kepuh Seeds (*Sterculia foetida*) Biodiesel from Various Sites on Java Island to Support Indonesia's Renewable Energy Development

Caesar Kartika Yoga[1], Sigit Sunarta[2)], Widiyatno[2)]

ABSTRACT

Biodiesel is a renewable and environmental friendly fuel produced by the chemical reaction of oil with alcohol and catalyst. Kepuh (*Sterculia foetida*) is an alternative plant to replace palm oil tree as raw material for making biodiesel. Kepuh is distributed in various places growing on Java island. Characteristics of kepuh biodiesel quality from various sites has not been studied. This study aims to determine the quality of biodiesel from various growth sites, correlation with geographical conditions, and clustering biodiesel based on biodiesel quality.

Kepuh seeds was collected from 30 locations spread across Java Island using a purposive sampling method based on geographic information. Biodiesel was made through transesterification of kepuh seed oil extracted with expeller. The transesterification process was carried out at temperature of 60^{o}C, 1% KOH catalyst, and stirring speed of 1200 rpm for 1 hour. Biodiesel quantity testing was yield of kepuh biodiesel and biodiesel quality test was density, kinematic viscosity, acid number, saponification number, iodine number, cetane number, total glycerol, free glycerol, methyl ester content, monoglycerides, sulphated ash content, phosphorus, cloud point, and flash point. Chemical components was identified using GC-MS fatty acid derivatization method. Secondary data were longitude, latitude, altitude, mean annual rainfall (MAR), mean annual humidity (MAH), mean annual sunshine (MAS), dan mean annual temperature (MAT). The relationship between growing place and biodiesel quality identified by Pearson correlation. Biodiesel quality grouping was based on Ward method cluster analysis.

The results of the biodiesel yield calculated from kepuh oil raw materials ranged from 78.81–86.59%. The quality of the biodiesel showed density (836.3–889.7 kg/m3), kinematic viscosity (2.58–4.53 cSt), acid number (0.04–0.5 mg-KOH/g), saponification number (189.47–253.27 mg-KOH/g) iodine number (59.71–11.04 g-I2/100g) cetane number (46.47–60.31), total glycerol (0.013–0.052%), free glycerol (0.008–0.025%), methyl ester content (99.28–99.79%), monoglycerides (0.46–0.83%), sulphated ash content (0.003–0.057%), phosphorus (0.73–3.81 mg/kg), cloud point (-4–12^{o}C), and flash point (115–229^{o}C). GC-MS results showed the main fatty acid esters content, namely sterculic acid (57.5–69.16%) as the highest compound, followed by palmitic acid (11.95–18.81%), linoleic acid (4.47–9.52%), oleic acid (3.96–7.12%), and 10-octadecinoic acid (2.3–5.81%). Kepuh biodiesel was classified into 3 clusters. Cluster 1 showed the best results with high yield, high cetane number, and low cloud point while clusters 2 and 3 did not meet the standards as raw materials for biodiesel production. The relationship between biodiesel quality and environmental factors showed that longitude, latitude, altitude, MAR, MAH, and MAS affected the quality of kepuh biodiesel.

Keywords: energy, biodiesel, kepuh seeds, geographical location

[1] Mahasiswa Magister Ilmu Kehutanan, Universitas Gadjah Mada
[2] Dosen Fakultas Kehutanan, Universitas Gadjah Mada