

ABSTRAK

SINTESIS BIODIESEL DARI MINYAK MIKROALGA

Skeletonema costatum

Biodiesel merupakan bahan bakar terbarukan yang dianggap efektif dalam mengurangi ketergantungan pada bahan bakar fosil. Biodiesel disintesis melalui reaksi transesterifikasi dari minyak nabati. Mikroalga berpotensi sebagai sumber biodiesel karena memiliki produktivitas minyak yang lebih tinggi dibandingkan tumbuhan lain. Mikroalga jenis *Skeletonema costatum* dipilih sebagai bahan baku alternatif biodiesel karena laju pertumbuhan yang cepat dengan waktu penggandaan (*doubling time*) yang singkat, sehingga memungkinkan produksi biomassa yang lebih efisien. Penelitian ini bertujuan untuk menentukan kadar asam lemak bebas dalam minyak hasil ekstraksi mikroalga *Skeletonema costatum*, mengidentifikasi komponen dan kadar metil ester asam lemak dari biodiesel yang dihasilkan, serta menganalisis mutu minyak biodiesel tersebut. Proses ekstraksi mikroalga *Skeletonema costatum* menggunakan metode soxhletasi dengan pelarut n-heksana, yang menghasilkan rendemen sebesar 6,1277%. Analisis kadar asam lemak bebas dalam mikroalga mencapai 1,92%, sehingga tidak diperlukan tahap esterifikasi. Setelah ekstraksi minyak mikroalga, proses transesterifikasi dilakukan dengan katalis KOH 1,5% untuk mengubah trigliserida menjadi metil ester. Kemudian, produk biodiesel dianalisis kandungan dan kadar metil ester asam lemak dengan menggunakan *Gas Chromatography Mass Spectrometry* (GC-MS). Hasil analisis biodiesel dengan GC-MS menunjukkan beberapa kandungan *Fatty Acid Methyl Ester* (FAME), antara lain metil heksadekanoat (3,26%), metil 12-metiltetradekanoat (2,2%), metil 9-oktadekanoat (1,73%), metil 9-heksadekanoat (1,3%), dan metil 11-siklopentilundekanoat (1,08%). Berdasarkan hasil penelitian, biodiesel yang dihasilkan dari mikroalga *Skeletonema costatum* telah memenuhi standar mutu SNI-04-7182-2015 dari beberapa parameter, seperti massa jenis 856,499 kg/m³, viskositas 3,61 mm²/s, bilangan asam 0,3262 mg KOH/g, dan warna nyala api yaitu sedikit biru kemerahan dengan reaksi pembakaran yang lebih cepat.

Kata Kunci: biodiesel; *gas chromatography mass spectrometry* (GC-MS); metil ester; mikroalga *Skeletonema costatum*; transesterifikasi.

ABSTRACT

SYNTHESIS OF BIODIESEL FROM MICROALGAE OIL

Skeletonema costatum

*Biodiesel is a renewable fuel that is considered effective in reducing dependence on fossil fuels. Biodiesel is synthesized through the transesterification reaction of vegetable oil. Microalgae can potentially serve as a biodiesel source due to their higher oil productivity than other plants. The microalga *Skeletonema costatum* was selected as an alternative biodiesel feedstock because of its rapid growth rate and short doubling time, allowing for more efficient biomass production. This study aims to determine the free fatty acid content in the extracted oil from *Skeletonema costatum* microalgae, identify the components and concentrations of Fatty acid methyl esters in the produced biodiesel, and analyze its fuel quality. The extraction process of *Skeletonema costatum* microalgae used the Soxhlet method with n-hexane as the solvent, resulting in a yield of 6,1277%. The free fatty acid content in the microalgae reached 1,92%, indicating that an esterification step was not required. After oil extraction, the transesterification process was carried out with 1,5% KOH as a catalyst to convert triglycerides into methyl esters. The biodiesel product was analyzed for its composition and concentration of fatty acid methyl esters using Gas Chromatography Mass Spectrometry (GC-MS). The GC-MS analysis of the biodiesel revealed the presence of several Fatty Acid Methyl Esters (FAME) compounds, including methyl hexadecanoate (3,26%), methyl 12-methyltetradecanoate (2,2%), methyl 9-octadecenoate (1,73%), methyl 9-hexadecenoate (1,3%), and methyl 11-cyclopentylundecanoate (1,08%). Based on the research findings, the biodiesel produced from *Skeletonema costatum* microalgae met the quality standards of SNI-04-7182-2015 in several parameters, such as density 856,499 kg/m³, viscosity 3,61 mm²/s, acid number 0,3262 mg KOH/g, and flame color, which exhibited a slightly reddish-blue hue with a faster combustion reaction.*

*Keywords: biodiesel; gas chromatography mass spectrometry (GC-MS); methyl esters; *Skeletonema costatum* microalgae; transesterification.*