Simulasi Proses Produksi Bio-hidrokarbon Berbasis Asam Palmitat Dengan Utilisasi Enzim Chlorella Variabilis Fatty Acid Photodecarboxylase (CvFAP) = Simulation of Palmitic Acid-Based Photodecarboxylation Process by Utilizing Chlorella variabilis Fatty Acid Photodecarboxylase (CvFAP) enzyme for Bio-Hydrocarbon Production

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Abstrak

Hidrokarbon merupakan susunan senyawa utama pembentuk bahan bakar minyak di kehidupan kita sehari-hari. Produksi hidrokarbon secara konvensional menimbulkan isu lingkungan dan persaingan kebutuhan energi untuk sektor lainnya, seperti industri pangan, pertanian, perindustrian, dan lain-lain. Maka dari itu, sumber energi alternatif mikroalga sebagai bioenergi generasi ke-tiga marak dikembangkan contohnya Chlorella variabilis untuk pengembangan Fatty Acid Phototdecarboxylase (CvFAP). CvFAP ini akan mengkatalisasi proses dekarboksilasi dan mensintesis hidrokarbon dengan kondisi proses yang lebih efektif dan ramah lingkungan. Penelitian ini bertujuan untuk menganalisis pengaruh variasi parameter proses yang terbagi menjadi tiga tahapan yaitu kultur mikrolaga dalam photobioreactor bubble (laju volumetrik gas, yield CO2, dan jenis sparger), purifikasi protein Chlorella variabilis dengan ion-exchange chromatography (porositas bed, porositas adsorben, dan kecepatan interstitial), dan sintesis hidrokarbon berbasis asam palmitat dalam fixed-bed reactor (konsentrasi substrat, kecepatan superfisial, temperatur, panjang reaktor, diameter reaktor, dan diameter partikel bed) untuk mendapatkan parameter optimum. Dengan melakukan simulasi model diferensial dan penetapan kondisi optimum terhadap ketiga tahapan tersebut, didapati parameter optimum seperti peningkatan konsentrasi 767,97% dari konsentrasi awal mikroalga hasil kultivasi, sebanyak 99,75% terpurifikasi dari crude protein, dan 38,80% konversi dengan selektivitas produk pentadekana 76,79% dan heksadekana 23,21% dari total produk hasil konversi

.....Hydrocarbons are the main compounds forming fuel oil in our daily lives. Conventional hydrocarbon production raises environmental issues and competition for energy needs for other sectors, such as the food industry, agriculture, industry, and others. Therefore, alternative energy sources of microalgae as third-generation bioenergy are being developed, for example, Chlorella variabilis for the development of Fatty Acid Phototecarboxylase (CvFAP). CvFAP will catalyze the decarboxylation process and synthesize hydrocarbons with more effective and environmentally friendly process conditions. This study aims to analyze the effect of variations in process parameters which are divided into three stages, which are microalgae culture in the photobioreactor bubble (gas volumetric rate, CO2 yield, and type of sparger), purification of Chlorella variabilis protein by ion-exchange chromatography (bed porosity, adsorbent porosity, and interstitial velocity), and synthesis of hydrocarbons based on palmitic acid in the fixed-bed reactor (substrate concentration, superficial velocity, temperature, reactor length, reactor diameter, and particle bed diameter) to obtain the optimum parameters. By simulating the differential model and determining the optimum conditions for the three stages, optimum parameters were found such as an increase in the concentration of 767.97% from the initial concentration of cultivated microalgae, as much as 99.75% purified from crude protein and 38.80% conversion with product selectivity. pentadecane 76.79%

and hexadecane 23.21% of the total converted product