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HASIL PENILAIAN SEJAWAT SEBIDANG ATAU PEER REVIEW
KARYA ILMIAH: JURNAL ILMIAH

Judul Karya Ilmiah (Artikel)	:	Biodiesel Production from Methanolysis of Lard Using CaO Catalyst Derived from Eggshell: Effects of Reaction Time and Catalyst Loading		
Nama Penulis	:	**Luqman Buchori,** Didi Dwi Anggoro, Anwar Ma'ruf		
Jumlah Penulis	:	3 orang		
Status Pengusul	:	**Penulis Pertama dan Penulis Korespondensi**		
Identitas Jurnal Ilmiah	:	a. Nama Jurnal	:	Advances in Science, Technology and Engineering Systems Journal
		b. Nomor ISSN	:	2415-6698
		c. Volume, nomor, bulan, tahun	:	Volume 6, No. 2, April 2021, pp. 399-404
		d. Penerbit	:	ASTES Publishers
		e. DOI artikel (jika ada)	:	https://dx.doi.org/10.25046/aj060246
		f. Alamat URL Jurnal	:	https://astesj.com/v06/i02/p46/
		Alamat URL Artikel	:	https://astesj.com/v06/i02/p46/
		g. Terindeks	:	Google Scholar, Crossref DOI

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NIP. 197405231998021001
(Bidang Ilmu/Unit kerja : Teknik Kimia/Universitas Diponegoro)

Reviewer 1

Prof. Dr. Ir. Bakti Jos, DEA
NIP. 196005011986031003
(Bidang Ilmu/Unit kerja : Teknik Kimia/Universitas Diponegoro)

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Reviewer 1

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NIP. 196005011986031003
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Semarang, 27 Mei 2021
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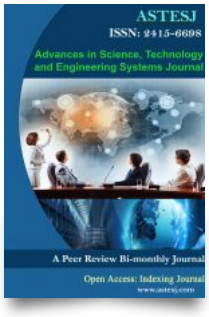

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Advances in Science, Technology and Engineering Systems Journal Vol. 6, No. 2, 399-404 (2021)

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Biodiesel Production from Methanolysis of Lard Using CaO Catalyst Derived from Eggshell: Effects of Reaction Time and Catalyst Loading

Luqman Buchori[1,*], Didi Dwi Anggoro[1], Anwar Ma'ruf[2]

[1]*Department of Chemical Engineering, Faculty of Engineering, Diponegoro University, Jl. Prof. Soedarto, SH, Tembalang, Semarang 50275, Indonesia*

[2]*Department of Chemical Engineering, Faculty of Engineering and Science, Muhammadiyah University of Purwokerto, Jl. Raya Dukuh Waluh, Purwokerto 53182, Indonesia*

ARTICLE INFO

Article history:
Received: 25 January, 2021
Accepted: 06 March, 2021
Online: 17 March, 2021

Keywords:
Biodiesel
CaO Catalyst
Lard

ABSTRACT

Biodiesel was produced from lard using a CaO catalyst derived from eggshells. The effects of catalyst loading and transesterification reaction time were investigated. The results revealed that the increase in yield of biodiesel occurred at all catalyst loading when the reaction time was increased. The optimal reaction time was obtained at 60 minutes. The results also indicated that there was an increase in yield of biodiesel when the catalyst loading was increased from 0.5% to 1%. Furthermore, increases in catalyst loading decreased biodiesel yields. The most optimum biodiesel yield of 92.69% was achieved when the reaction time, catalyst loading, methanol:oil molar ratio, reaction temperature, and pressure were 60 minutes, 1%, 6:1, 65 °C, and 1 atm, respectively. The FAME content in biodiesel product was 95.28%. The biodiesel obtained reflected a cetane number and heating value of 46.2 and 37.86 MJ/kg, respectively. Eggshell-derived CaO catalysts exhibited excellent reusability.

1. Introduction

Biodiesel is currently being developed as an alternative fuel on account of its many advantages over diesel oil, which include non-toxicity, environmentally friendly, biodegradability, high cetane number, and low emission [1, 2]. Biodiesel is a renewable resource composed of a mixture of various FAAE (fatty acid alkyl esters). Biodiesel, as a renewable alternative energy, can be made from vegetable oils and animal fats as a source of raw materials [3, 4]. Biodiesel can be obtained by esterification or transesterification process. Esterification process is the reaction of FFA (free fatty acids) with alcohol to produce FAME (fatty acid methyl ester) and water [5]. Transesterification is a reaction between triglycerides that can be obtained from oil derived from plants or fats from animals with alcohol to produce FAME and glycerol as a by-product [6, 7]. Esterification is carried out if the FFA content of the raw materials is higher than 2% [8, 9]. If the FFA content <1%, biodiesel synthesis is carried out by transesterification only.

Of the various types of vegetable oils, the most commonly used to produce biodiesel include rapeseed oil (in Canada), sunflower oil (in Southern Europe), soybean oil (in the United States), palm oil (in South Asian countries, especially Malaysia. and Indonesia), as well as castor oil (in India) [5, 10]. The utilization of animal fats as feedstock for biodiesel production has also been previously studied. Among the animal fats studied were lard, beef tallow, and fish oil [11, 12]. Compared to vegetable oils, biodiesel from animal fats shows several advantages, including high calorific value and cetane number [10]. However, biodiesel from animal fats also shows disadvantages, including high saturated fatty acid contents, plugging points and cold filter clouding point, which can cause problems during winter operations [11, 13].

Biodiesel synthesis from lard has been studied by several researchers [11, 13–18]. In [11] and [15], for example, the authors used KOH as a catalyst and produced biodiesel with FAME contents of 88.7% and 99.4%, respectively. In [18], the authors also used catalysts of 1.25% KOH and obtained a FAME yield of 96%. The biodiesel production from a mixture of soybean oil and lard using NaOH catalyst has been studied [13], which obtained a biodiesel yield of 77.8%. In [14], the authors investigated the transesterification of refined lard. The research was carried out in supercritical methanol. In this work, the transesterification process

*Corresponding Author: Luqman Buchori, Email: luqman.buchori@che.undip.ac.id

Advances in Science, Technology and Engineering Systems Journal Vol. 6, No. 2, 01-11 (2021)

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Special Issue on Advanced Electrical and Communication Technologies

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How Ready is Renewable Energy? A Review Paper on Educational Materials and Reports Available for the Teaching of Hydrogen Fuel Cells in Schools

Tan Pey Fang[*,1], Wan Ramli Wan Daud[2], Lilia Halim[3], Mohd Shahbudin Masdar[4]

[1]*Centre for Engineering Education Research, Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia 43600 UKM Bangi, Malaysia*

[2]*Department of Chemical & Process Engineering, Faculty of Engineering and Built Environment[1], Fuel Cell Institute (SELFUEL), Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Malaysia*

[3]*Department of Education Policy & Leadership, Faculty of Education, Universiti Kebangsaan Malaysia 43600 UKM Bangi, Malaysia*

[4]*Department of Chemical & Process Engineering, Centre for Engineering Education Research, Faculty of Engineering and Built Environment, Fuel Cell Institute (SELFUEL)[2], Universiti Kebangsaan Malaysia 43600 UKM Bangi, Malaysia*

ARTICLE INFO

Article history:
Received: 10 February, 2020
Accepted: 09 February, 2021
Online: 10 March, 2021

Keywords:
Engineering education
RE
Hydrogen fuel cell teaching programme
Covid-19 online learning

ABSTRACT

Today, the costs of most Renewable Energy (RE) technologies especially hydrogen energy technologies such as fuel cells, are still beyond the means of poorer economies in developing countries. Hence, there is little public awareness and local expertise in RE in these countries and even lesser in hydrogen energy. To solve this problem, it is important to train local manpower in RE, starting with enabling local schoolchildren to learn about RE, especially hydrogen fuel cells. RE provides an alternative, sustainable and clean energy that improves the environment and human life, expands the choice of available energy sources that improves energy security, and reduces consumption of fossil energy in electricity generation and public transportation. Hence it is critical that teaching modules for exposure, acceptance and uptake of RE technologies are developed to suit local conditions. The purpose of this paper is to review recent progress and advances in RE education especially in hydrogen fuel cell. Important features of the modules, educational materials and reports are discussed critically. This paper assesses the literature on RE teaching in schools, especially in hydrogen fuel cells, and discusses the problems faced and the optimal period for cost-effectiveness. A curriculum that integrates literacy and social concepts with science, technology, engineering and mathematics (STEM) concepts could be developed in the future. The literature shows that teaching and learning of fuel cells could be achieved by using the five "Es"; Engagement, Exploration, Explanation, Elaboration and Evaluation, and also by promoting collaboration, team work, communication and design in project based learning activities. Most teaching materials include a project for students to build their own single-cell Proton Exchange Membrane (PEM) fuel cells and electrolyzers, and to produce hydrogen by using solar energy. Appropriate and economic criteria are developed for the design and development of modules for teaching and learning of hydrogen fuel cells, which could be implemented in physical classrooms or on free blended online learning platforms during the COVID-19 pandemic.

1. Introduction

Since the international oil embargo crisis in the 1970s that had threatened energy security of the world, the idea of developing Renewable Energy (RE) has been widely acknowledged as a measure to stave off a recurrence of the embargo. The increasing acceptance of RE has been primarily attributed to the depletion of fossil fuels especially after the oil embargo crisis. Climate change

[*]Corresponding Author: Tan Pey Fang, tanpeyfang@gmail.com

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Advances in Science, Technology and Engineering Systems Journal Vol. 6, No. 2, 29-35 (2021)

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Curved Pyramidal Metamaterial Absorber: From Theory to an Ultra-Broadband Application in the [0.3 - 30] GHz Frequency Band

Zeinab Fneish[1,2,3,*], Hussam Ayad[1], Moncef Kadi[2], Jalal Jomaa[4], Ghaleb Faour[3]

[1]*Lebanese University, Physics Departement, Faculty of Science, Beirut, 2038, Lebanon*

[2]*Normandie University, Ecole superieur d'ingenieur ESIGELEC, Research Institute, Rouen, 76800, France*

[3]*Scientific Research National Center (CNRS), Beirut, 2038, Lebanon*

[4]*Maaref University, Beirut, 2038, Lebanon*

ARTICLE INFO

Article history:
Received: 20 September, 2020
Accepted: 04 February, 2021
Online: 10 March, 2021

Keywords:
Metamaterial absorber
Relative Absorptive Bandwidth
Absorption
Resonance
Curved Altitude
Pyramidal Absorber
Broadband Response

ABSTRACT

For its importance nowadays in a wide range of applications such as the anechoic chamber, we introduce a microwave ultra-broadband polarization-independent metamaterial absorber (MA) in the Ultra High Frequency (UHF)/ Super High Frequency (SHF) frequency bands. Through this work, we improved the Relative Absorptive Bandwidth (RAB) of the conventional pyramidal absorber (CPA) by modifying its altitude to a curved shape. As a result, the RAB increased from 25.9 % to 71.82 % with an absorptive level greater than 90% paving the way to an optimized structure for a broader band of absorption. As a second target, we looked for widening the broadband absorption of the CPA in the low-frequency region. To achieve this aim, we introduced two new prototypes. The first with a total thickness of 12.7 cm, consisting of 35 curved resonant layers where numerical simulations show an enhanced design with an absorption band from 0.3 GHz to 30 GHz referring ta a RAB of 182%. The second prototype consists of a cell containing different pyramidal absorbers grouped in-plane in a unit cell; such structures operate in complementary bands. This prototype is dedicated to combining these bands of absorption. After that, an enhancement is presented of this latest to reach a well-combined band with a RAB of 128.69%. We used for simulation, testing, and collecting results the High-Frequency Structure Simulator (HFSS) tool.

1. Introduction

This paper is an extension of work originally presented at the *7th Mediterranean Congress of Telecommunications (CMT) conference* [1] where we presented an enhanced prototype of a broadband electromagnetic Metamaterial Absorber (MA).

Because of its matched impedance due to the electric and magnetic resonance, the MA is able to omit the reflection by strongly absorbing the incident wave in the dielectric [2]. Based on the latter proposition and in different frequency bands [3-6], other designs of MAs have been introduced. Because its principle is based on resonance, the absorption bandwidth of MAs relies on narrow resonant frequencies. However, broadband absorption is an important factor in many applications one of them is the anechoic chamber. To overcome this issue, the literature proposes to increase the number of simple resonators with size variation either in longitudinal directions [6] as the pyramidal Absorber (PA) structure by stacking patches resonators or in transverse directions [7]. One of the novelties addressed in this article is a novel prototype that combines these two ways in one model in such a way that the PA structure is used as a part of a unit cell that has different PAs with size variation in the transverse direction.

Because its negligible incident angle dependence [8] and its negligible polarization dependence due to its symmetrical design geometry, the PAs structures achieve a great importance. PA is composed of a periodic array of multilayered patches forming a quadrangular pyramid where these pyramids possess resonant

*Corresponding Author: Zeinab Fneish, fneichzeinab@gmail.com