

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

Judul Karya Ilmiah (artikel) : Ultrasound-Assisted Ultra-Mild-Acid Hydrolysis of  $\kappa$ -Carrageenan  
 Nama Penulis : Ratnawati Ratnawati, Nita Indriyani  
 Jumlah Penulis : 2  
 Status Pengusul : penulis pertama/penulis korespondensi  
 Identitas Jurnal Ilmiah : a. Nama Jurnal : Reaktor  
 b. Nomor ISSN : 0852-0798 (p); 2407-5973 (e)  
 c. Volume, Nomor, Bulan, Tahun : Vol. 17, no. 4, 2017  
 d. Penerbit : Universitas Diponegoro  
 e. DOI artikel (jika ada) : 10.14710/reaktor.17.4.191-196  
 f. Alamat web Jurnal :  
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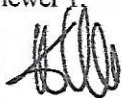
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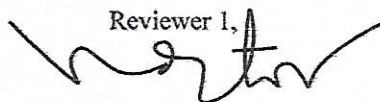
Semarang, April 2020

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Prof. Dr. Istadi, ST, MT  
 NIP 197103011997021001  
 Unit Kerja : Universitas Diponegoro  
 Bidang Ilmu : Teknik Kimia

Reviewer 1,



Prof. Dr. Hadyanto, ST, MSc.  
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| Total = 100%                                                    |                                         | 25,0                   |                                                       | 24,0                       |
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| Ruang lingkup dan kedalaman pembahasan (30%)                   |                                         | 7,5                    |                                                       | 7.15                       |
| Kecukupan dan kemutakhiran data/informasi dan metodologi (30%) |                                         | 7,5                    |                                                       | 7.15                       |
| Kelengkapan unsur dan kualitas terbitan/jurnal (30%)           |                                         | 7,5                    |                                                       | 6.87                       |
| Total = 100%                                                   |                                         | 25,0                   |                                                       | 23.42                      |
| Nilai Pengusul                                                 | 60% $\times$ 23.42                      |                        |                                                       | 14.05                      |

**Catatan Penilaian Artikel oleh Reviewer:**

- a. **Kelengkapan unsur isi artikel (10%).** Artikel ini memiliki unsur yang lengkap (Abstract, Introduction, Method, Results & Discussion, Conclusion, Refreneces). State of the art dan tujuan dinyatakan dengan jelas. Penulisan daftar pustaka dan *in-text citation* konsisten dan sesuai dengan petunjuk penulisan. Hasil cek plagiarisme dengan Turnitin menunjukkan kesamaan sebesar 15%.  $\rightarrow$  (nilai = 9%=)
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 Bidang Ilmu : Teknik Kimia  
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| Optimasi pembuatan kitosan dari kitin limbah cangkang rajungan ( <i>Portunus pelagicus</i> ) untuk adsorben ion logam merkuri<br>LH Rahayu, S Purnavita<br>Reaktor 11 (1), 45-49                                               | 53       | 2007 |
| Pengaruh proses pengeringan rimpang temulawak ( <i>Curcuma xanthorrhiza</i> roxb) terhadap kandungan dan komposisi kurkuminoid<br>B Cahyono, MDK Huda, L Limantara<br>Reaktor 13 (3), 165-171                                  | 48       | 2011 |
| Karakteristik fisikokimia pati sagu hasil pengeringan secara fluidisasi menggunakan alat pengering cross flow fluidized bed bertenaga surya dan biomassa<br>A Jading, E Tethool, P Payung, S Gultom<br>Reaktor 13 (3), 155-164 | 44       | 2011 |
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| Pembuatan gula non karsinogenik non kalori dari daun stevia<br>L Buchori<br>Reaktor 11 (2), 57-60                                                                                                                              | 42       | 2007 |
| Characterisation of solid and liquid pineapple waste<br>A Abdullah, H Mat<br>Reaktor 12 (1), 48-52                                                                                                                             | 40       | 2008 |
| Preparasi dan karakterisasi zeolit dari abu layang batubara secara alkali hidrotermal<br>J Jumaeri, W Astuti, WTP Lestari<br>Reaktor 11 (1), 38-44                                                                             | 26       | 2007 |
| Ekstraksi Oleoresin Dari Kayu Manis Berbantu Ultrasonik Dengan Menggunakan Pelarut Alkohol<br>B Jos, B Pramudono, A Aprianto<br>Reaktor 13 (4), 231-236                                                                        | 18       | 2011 |
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| A Ahmad, A Wahid<br>Reaktor 11 (2), 66-70                                                                                                                                                                                                                          |          |      |
| Morfologi dan Properti Campuran Karet Alam/Polypropylene yang Divulkanisasi Dinamik dalam Internal Mixer<br>B Bahruddin, S Sumarno, G Wibawa, N Soewarno<br>Reaktor 11 (2), 71-77                                                                                  | 15       | 2007 |
| Studi penggunaan katalis abu sabut kelapa, abu tandan sawit dan K <sub>2</sub> CO <sub>3</sub> untuk konversi minyak jarak menjadi biodiesel<br>H Husin, M Mahidin, M Marwan<br>Reaktor 13 (4), 254-261                                                            | 14       | 2011 |
| Pemutihan pulp dengan hidrogen peroksida<br>AM Fuadi, H Sulistya<br>Reaktor 12 (2), 123-128                                                                                                                                                                        | 14       | 2008 |
| The effect of type zeolite on the gas transport properties of polyimide-based mixed matrix membranes<br>TD Kusworo, AF Ismail, A Mustafa, K Li<br>Jurnal REAKTOR 12 (2), 68-77                                                                                     | 14       | 2008 |
| Pengolahan Limbah Cr (VI) dan Fenol Dengan Fotokatalis Serbuk TiO <sub>2</sub> Dan CuO/TiO <sub>2</sub><br>S Slamet, R Arbianti, E Marliana<br>Reaktor 11 (2), 78-85                                                                                               | 14       | 2007 |
| Pengaruh derajat deasetilasi khitosan dari kulit udang terhadap aplikasinya sebagai pengawet makanan<br>N Rokhati<br>Reaktor 10 (2), 54-58                                                                                                                         | 14       | 2006 |
| Paddy drying in mixed adsorption dryer with zeolite: drying rate and time estimation<br>M Djaeni, D Ayuningtyas, N Asiah, H Hargono, R Ratnawati, W Wiratno, ...<br>Reaktor 14 (3), 173-178                                                                        | 13       | 2013 |
| Sintesis Turunan Polieugenol sebagai Carrier bagi Recovery Logam Berat dengan Teknik Membran Cair<br>MC Djunaidi<br>Jurnal REAKTOR 13 (1), 16-23                                                                                                                   | 13       | 2010 |
| Proses gliserolisis minyak kelapa sawit menjadi mono dan diacyl gliserol dengan pelarut N-butanol dan katalis MgO<br>DD Anggoro, SB Faleh<br>Reaktor 12 (1), 22-28                                                                                                 | 13       | 2008 |
| Produksi Karbon Aktif dari Batubara Bituminus dengan Aktivasi Tunggal H <sub>3</sub> PO <sub>4</sub> , Kombinasi H <sub>3</sub> PO <sub>4</sub> -NH <sub>4</sub> HCO <sub>3</sub> , dan Termal<br>E Kusdarini, A Budianto, D Ghafarunnisa<br>Reaktor 17 (2), 74-80 | 11       | 2017 |

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Back Matter



## Ultrasound-Assisted Ultra-Mild-Acid Hydrolysis of $\kappa$ -Carrageenan

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### Abstract

The low molecular weight fraction of  $\kappa$ -carrageenan is useful in biomedical applications. An ultrasound-assisted acid hydrolysis of  $\kappa$ -carrageenan has been studied.  $\kappa$ -carrageenan with an initial number-average molecular weight of 629 kDa was dispersed in distilled water to form a 5 g/l solution. The pH (3 and 6) of the solution was adjusted by adding HCl solution. The depolymerization reaction was carried out in an ultrasonic device at various temperatures (30, 40, 50, and 60 °C) and times (8, 16, 24, and 32 min). The experimental results showed that ultrasound positively contributed to acid hydrolysis process. The number-average molecular weight of the treated  $\kappa$ -carrageenan was lower or the percentage of reduction was higher at lower pH, longer reaction time, and higher temperature. The lowest number-average molecular weight (14 kDa) or the highest percent of molecular weight reduction (97.7%) was achieved after ultrasonic irradiation at 60 °C and pH 3 for 32 min.

**Keywords:** depolymerization; midpoint scission; ultrasonication

**How to Cite This Article:** Ratnawati, R. and Indriyani, N., (2017), Ultrasound-Assisted Ultra-Mild-Acid Hydrolysis of  $\kappa$ -Carrageenan, Reaktor, 17(4), 191-196, <http://dx.doi.org/10.14710/reaktor.17.4.191-196>

### INTRODUCTION

$\kappa$ -carrageenan, extracted from red seaweed *Kappaphycus alvarezii*, is widely used as stabilizer, thickener, gelling agent, and emulsifier in food, pharmaceutical, cosmetic, and textile industries (Campo *et al.*, 2009). The utilization of  $\kappa$ -carrageenan can be expanded, especially in biomedical application, when the molecular weight is lower. Many groups of researchers have applied the low molecular weight fractions (LMWF) of  $\kappa$ -carrageenan in biomedical applications as tumor growth inhibitor (Yao *et al.*, 2014), antiviral (Chiu *et al.*, 2012), anticoagulant (Silva *et al.*, 2010; Gomez-Ordóñez *et al.*, 2014), and

antioxidant (de Souza *et al.*, 2012; Gomez-Ordóñez *et al.*, 2014).

The LMWF of  $\kappa$ -carrageenan used in the biomedical application has an average molecular weight less than 20 kDa (de Souza *et al.*, 2012). With such small molecular weight, the LMWF of  $\kappa$ -carrageenan can penetrate into human cells more effectively compared to that of the original high molecular weight  $\kappa$ -carrageenan (Wijesekara *et al.*, 2011). The negative charge of the LMWF of  $\kappa$ -carrageenan may interact with the positive charge of the outer wall of virus or cell, hindering the virus to penetrate into the cell (Bondu *et al.*, 2010).

## Corrosion Characteristics of Carbon Steel upon Exposure to Biodiesel Synthesized from Used Frying Oil

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### Abstract

*The use of biodiesel leads to corrosion of automotive material, which can potentially shorten engine lifetime. The study aims to investigate the effect of temperature and contact time on the corrosion characteristics of carbon steel upon exposure to biodiesel synthesized from used frying oil. The corrosion rate of carbon steel was analyzed based on weight loss measurement according to the standard of ASTM G31 as affected by temperature and contact time. The immersion temperatures used in this study were 30°C, 40°C, and 70°C, respectively. The contact times studied were 30 days, 40 days, and 50 days respectively. The results show that the increase of temperature and contact time of biodiesel on carbon steel surface speeds up the corrosion rate. Maximum corrosion rate (0.083 mmy) was observed on the carbon steel contacted to biodiesel at 70°C for 50 days. The SEM results showed an irregular shape of the corroded carbon steel surface. XRD / FTIR analysis of carbon steel samples show the presence of peaks, detected as Fe<sub>2</sub>O<sub>3</sub>, FeO(OH) and Fe<sub>2</sub>O<sub>2</sub>CO<sub>3</sub>, as the corrosion products.*

**Keywords:** biodiesel; carbon steel; corrosion; FAME; used frying oil

**How to Cite This Article:** Setiawan, A., Novitrie, N.A., Nugroho, A., and Widiyastuti, (2017), Corrosion Characteristics of Carbon Steel upon Exposure to Biodiesel Synthesized from Used Frying Oil, Reaktor, 17(4), 177-184, <http://dx.doi.org/10.14710/reaktor.17.4.177-184>

### INTRODUCTION

The advances of technology in industrial and transportation activities lead to the rapid increase of fossil fuel consumption so that its supply will decrease rapidly. Because fossil fuels are not renewable, this situation may lead to the crisis of energy in the future (Jin *et al.*, 2015). Nowadays, the world main issue in transportation is dominated by the use of petroleum based fuels, such as gasoline and diesel. Globally, the average energy consumption in transportation

increases as much as 1.1% each year as the result of automotive industries development. The transportation sector has been estimated to contribute about 63% in liquid fuel consumption since 2010 until 2040 (Mahmudul *et al.*, 2017). In addition, burning of fossil fuel causes environmental problem, especially in the form of air pollution (Thangavelu *et al.*, 2016). Various efforts have been made to find alternative renewable energies as substitute to fossil fuels so that the fossil fuel consumption rate in the future can be

## Identification of Compounds Released During Pyrolysis of Palm Kernel Shell (PKS) Using Pyrolysis-GC/MS

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### Abstract

Pyrolysis is one of thermochemical conversion to convert biomass into bio-oil. The higher energy content in bio-oil suggests its potential as a raw material in the production of energy, bio-fuels, and other chemicals. Pyrolysis of PKS and the chemicals released were studied using pyrolysis–gas chromatography/mass spectrometry (Py-GC/MS) at 400–600°C. Prior to pyrolysis, thermogravimetry experiments were carried out to monitor the degradation temperature of hemicellulose, cellulose, and lignin in the PKS. Degradation of hemicellulose occurred within a temperature range of 150–330°C, whereas the cellulose was degraded in temperatures range between 330–400°C. Degradation of lignin took place within a broad range of temperatures, which reached maximum at temperatures range of 200–500°C. Based on the Py-GC/MS results, pyrolysis of PKS at 400°C produced bio-oil that can be used as biofuel due to its high aromatic compounds but low carboxylic acids contents.

**Keywords:** bio-oil; chemical; palm kernel shell; Py-GC/MS; thermogravimetry

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### INTRODUCTION

Biomass is widely recognized as one of the potential solutions to worldwide future energy problems. One of the largest biomass resources from agricultural residues in Indonesia is palm kernel shell (PKS). This idea is based on the fact that the Indonesia palm oil production growth is about 10% per year (Indonesia Investments, 2015). Palm oil production generated approximately 6-7% PKS based on fresh fruit bunch (Umikalsom *et al.*, 1997; Chiew *et al.*, 2011; Husain *et al.*, 2002). Indeed, the availability of PKS with high carbon content as source of biomass fuel can be sustained. PKS is a lignocellulosic biomass

composed mainly of cellulose, hemicelluloses, and lignin. Currently, PKS is used as fuel for boiler through combustion with low thermal conversion efficiency (Husain *et al.*, 2002; Kim *et al.*, 2010; Asadullah *et al.*, 2013). However, technological barrier and lack study and information on indigenous properties of PKS and the physico-chemical properties of bio-oil from PKS has slowed down the commercial uptake of PKS for advanced energy production (Asadullah *et al.*, 2013).

Pyrolysis is the chemical decomposition of organic material (biomass) through the application of heat in the absence of oxygen. During the pyrolysis

## Kinetic Study of Oil Palm Empty Fruit Bunch Enzymatic Hydrolysis

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### Abstract

*As lignocellulosic biomass, Oil Palm Empty Fruit Bunch (OPEFB) can be used as the source of xylose that can be further utilized as the raw material for xylitol production. The processing of OPEFB to xylose comprises of pretreatment and hydrolysis that can be performed enzymatically. This process offers the advantages of moderate operation conditions and more environmentally friendly. This article describes the kinetic study of enzymatic hydrolysis process of OPEFB for producing xylose using self-prepared and commercial xylanase enzymes. Despite the possible mass transfer limitation, the Michaelis Menten kinetics was hypothesized. The results indicated that the reaction at pH 5 and 60°C followed the Michaelis Menten kinetics, with  $V_m$  of 0.84 g/L-h and  $K_m$  of 48.5 g/L for the commercial enzyme, and  $V_m$  of 0.38 g/L-h and  $K_m$  of 0.37 g/L for the self-prepared enzyme. The reaction is affected by temperature, with  $E_a$  of 8.6 kcal/gmol. The performance of self-prepared xylanase enzyme was not yet as good as the commercial enzyme, Cellic Htec 2.*

**Keywords:** enzymatic hydrolysis; kinetics parameter; OPEFB; xylanase; xylose

**How to Cite This Article:** Meilany, D., Mardawati, E., Kresnowati, M.T.A.P., and Setiadi, T., (2017), Kinetic Study of Oil Palm Empty Fruit Bunch Enzymatic Hydrolysis, Reaktor, 17(4), 197-202, <http://dx.doi.org/10.14710/reaktor.17.4.197-202>

### INTRODUCTION

Oil palm is one of the important industrial plants in Indonesia. Recorded until the end of 2015, the estimated area of productive Indonesia's oil palm plantations is  $\pm 10.9$  million hectares (Ditjenbun, 2014), while the annual Crude Palm Oil (CPO) production reached  $\pm 32.5$  million tonnes. About 23% of Fresh Fruit Bunch ends up as the Oil Palm Empty Fruit Bunch (OPEFB), which is now commonly used only as organic fertilizer or reused in the oil palm plantations as the mulch. However, not all of OPEFB can be used as organic fertilizer, so it will surely be accumulated and raise an environmental problem.

Lignocellulosic biomass composed of polysaccharides, such as cellulose and hemicellulose as well as lignin. In the concept of biorefinery, lignocellulosic biomass can be treated in the following step. First is pretreatment for releasing cellulose and hemicellulose, followed by hydrolysis to depolymerize polysaccharide to its free sugar residual. Finally, fermentation is conducted to convert free sugars to more valuable product (Dutta and Chakraborty, 2015).

Xylose is one of those free sugars stated earlier. It can be used to produce xylitol, a polyol with almost the same sweetness as sucrose but much safer for