

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

Judul Jurnal Ilmiah (Artikel) : UV Irradiation and Ozone Treatment of  $\kappa$ -Carrageenan: Kinetics and Products Characteristics

Jumlah Penulis : 5 orang

Status Pengusul : **Penulis pertama**

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- b. Nomor ISSN : 1978-2993, (Q3)
- c. Volume, Nomor, Bulan, Tahun : 15/2/Agustus/2020
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- e. DOI artikel (jika ada) : <https://doi.org/10.9767/bcrec.15.2.7047.319-330>
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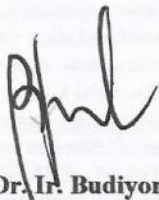
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**Prof. Ir. Didi Dwi Anggoro, M.Eng., PhD**  
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Kesesuaian dan kelengkapan unsur isi jurnal baik. Penyusunan artikel sesuai dengan template jurnal BCREC: abstract, introduction, material and methods, results and discussions, conclusions, acknowledgments serta references.
- b. **Ruang lingkup dan kedalaman pembahasan:**  
Artikel ini memiliki ruang lingkup dan kedalaman pembahasan yang baik. *Novelty* adalah mengkaji model kinetika reaksi proses dipolimcrisasi karageenan dengan iradiasi UV dan ozonasi. Ruang lingkup sesuai dengan bidang ilmu teknik kimia. Pembahasan cukup komprehensif dengan jumlah sitasi dalam pembahasan sebanyak 26 artikel dari 41 pustaka yang diacu atau 63,41%.
- c. **Kecukupan dan kemutakhiran data/informasi dan metodologi:**  
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## Research Article

## UV Irradiation and Ozone Treatment of $\kappa$ -Carrageenan: Kinetics and Products Characteristics

Aji Prasetyaningrum<sup>1,\*</sup>, W. Widayat<sup>1</sup>, Bakti Jos<sup>1</sup>, Yudhy Dharmawan<sup>2</sup>, R. Ratnawati<sup>1</sup>

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### Abstract

The low molecular weight (LMW) of sulfated polysaccharides including  $\kappa$ -carrageenan, is shows a wide spectrum of biological activities. This research investigates the influence of UV irradiation, ozone (O<sub>3</sub>), and the combination of O<sub>3</sub>/UV methods on the depolymerization of  $\kappa$ -carrageenan. The depolymerization kinetics of  $\kappa$ -carrageenan using the Advanced Oxidation Process (UV/O<sub>3</sub>) was also studied. Furthermore, the intrinsic viscosity method was used to determine the average molecular weight of the research sample, and a mathematical model was developed to predict the kinetic rate constant, as a function of ozone dosage and UV irradiation intensity. Therefore, the physicochemical and morphological properties of the degraded  $\kappa$ -carrageenan were analyzed by FT-IR, SEM, and XRD. The intrinsic viscosity  $\kappa$ -carrageenan decreases with increasing UV light intensity and ozone concentration. The combination of UV/O<sub>3</sub> treatment appeared to be more effective than the individual approaches, as the highest kinetic rate constant for depolymerization was  $1.924 \times 10^{-4} \text{ min}^{-1}$ , using 125 mg/L ozone concentration and 40 mW/cm<sup>2</sup> of UV lamp intensity. This research also evaluated the relationship between various experimental conditions, including UV lamp power dissipation and ozone concentration on the reaction kinetics model, and the results suggest that lower effect is contributed by UV irradiation intensity. In addition, FT-IR spectra showed the absence of any significant change in the functional properties of  $\kappa$ -carrageenan treated with UV and O<sub>3</sub> processes, although the morphological properties of the LMW  $\kappa$ -carrageenan were rougher and more porous than the native  $\kappa$ -carrageenan. Copyright © 2020 BCREC Group. All rights reserved

**Keywords:**  $\kappa$ -carrageenan; UV irradiation; ozone; depolymerization

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### 1. Introduction

Carrageenan is a high molecular weight sulfated polygalactose obtained from the marine macroalgae (Rhodophyceae). These are further

classified according to the 3,6 anhydrogalactose present on the 4-linked residue, as well as the number and position of the sulfate group. Generally, three types have been identified, including the iota ( $\iota$ -), lambda ( $\lambda$ -) and kappa ( $\kappa$ -) carrageenan, which is specifically the most widely cultivated in Indonesian waters. The  $\kappa$ -carrageenan consists of a common D-galactose backbone, characterized by alternating  $\beta(1,3)$ -D-

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## Research Article

# One-Pot Access to Diverse Functionalized Pyran Annulated Heterocyclic Systems Using SCMNP<sub>s</sub>@BPy-SO<sub>3</sub>H as a Novel Magnetic Nanocatalyst

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## Abstract

The SCMNP<sub>s</sub>@BPy-SO<sub>3</sub>H catalyst was prepared and characterized using Fourier Transform Infrared Spectroscopy (FTIR), Thermogravimetric Analysis (TGA), Vibrating Sample Magnetometry (VSM), Energy Dispersive X-ray Spectroscopy (EDX), X-ray Diffraction (XRD), and Scanning Electron Microscopy (SEM). Afterwards, its capability was efficiently used to promote the one-pot, three-component synthesis of pyrano[2,3-*c*]pyrazole and 2-amino-3-cyano-pyrano[3,2-*c*]chromen-5(4*H*)-one derivatives. The strategy resulted in the desired products with excellent yields and short reaction times. The SCMNP<sub>s</sub>@BPy-SO<sub>3</sub>H catalyst was readily recovered using a permanent magnetic field and it was re-used in six runs with a slight decrease in catalytic activity. Copyright © 2020 BCREC Group. All rights reserved

**Keywords:** Multicomponent reaction; Solvent-free conditions; Magnetic nanocatalyst; SCMNP<sub>s</sub>@BPy-SO<sub>3</sub>H, pyrano[2,3-*c*]pyrazole; 2-amino-3-cyano-pyrano[3,2-*c*]chromen-5(4*H*)-one

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## 1. Introduction

In the last decade, considerable attention has been paid to the synthesis of Fe<sub>3</sub>O<sub>4</sub> magnetic nanoparticles (MNPs) in various fields of applications due to their unique features, such as: high surface area, superparamagnetic behavior, low toxicity, biocompatibility, suitability for large-scale generation, simple recovery, and coupling with organic and inorganic molecules [1-9]. Coating an organic (biowastes) or inorganic (bentonite, alumina, silica, zeolite, and metal

oxides) support surface on MNPs prevents these nanomaterials from agglomeration due to the strong dipole-dipole attraction; it also improves their efficiency in terms of catalytic activity and simplify separation [10-11]. Surface modifying of Fe<sub>3</sub>O<sub>4</sub> magnetic nanoparticles with silica layer growth the available active sites and ameliorate the chemical stability [12]. Furthermore, because of the presence of active hydroxyl groups on the silica surfaces, a wide range of organic and inorganic linkers can be attached to them and promote their application in many chemical processes.

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## Research Article

**Totally-green Fuels *via* CO<sub>2</sub> Hydrogenation**Lorenzo Spadaro<sup>1,2,\*</sup>, Alessandra Palella<sup>1,\*</sup>, Francesco Arena<sup>1,2</sup><sup>1</sup>*Istituto CNR di Tecnologie Avanzate per l'Energia "Nicola Giordano", Via S. Lucia sopra Contesse n.5, 98126 Messina, Italy.*<sup>2</sup>*Dipartimento di Ingegneria, Università degli Studi di Messina, Viale F. Stagno D'Alcontres 31, I-98166, Messina, Italy.*

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**Abstract**

Hydrogen is the cleanest energy vector among any fuels, nevertheless, many aspects related to its distribution and storage still raise serious questions concerning costs, infrastructure and safety. On this account, the chemical storage of renewable-hydrogen by conversion into green-fuels, such as: methanol, *via* CO<sub>2</sub> hydrogenation assumes a role of primary importance, also in the light of a cost-to-benefit analysis. Therefore, this paper investigates the effects of chemical composition on the structural properties, surface reactivity and catalytic pathway of ternary CuO-ZnO-CeO<sub>2</sub> systems, shedding light on the structure-activity relationships. Thus, a series of CuZnCeO<sub>2</sub> catalysts, at different CuO/CeO<sub>2</sub> ratio (*i.e.* 0.2-1.2) were performed in the CO<sub>2</sub> hydrogenation reactions at 20 bar and 200-300 °C, (GHSV of 4800 STP L·kg·cat<sup>-1</sup>·h<sup>-1</sup>). Catalysts were characterized by several techniques including X-ray Diffraction (XRD), N<sub>2</sub>-physisorption, single-pulse N<sub>2</sub>O titrations, X-ray Photoelectron Spectroscopy (XPS), and Temperature-programmed Reduction with H<sub>2</sub> (H<sub>2</sub>-TPR). Depending on preparation method, the results clearly diagnostics the occurrence of synergistic structural-electronic effects of cerium oxide on copper activity, with an optimal 0.5 copper-to-cerium content. The rise of CuO loading up to 30% drives to a considerable increase of hydrogenation activity: C2Z1-C catalyst obtains the best catalytic performance, reaching methanol yield value of 12% at 300 °C. Catalyst activity proceeds according to volcano-shaped relationships, in agreement with a dual sites mechanism. Copyright © 2020 BCREC Group. All rights reserved

**Keywords:** Renewable energy; hydrogen-to-liquid-fuels (HTL); carbon dioxide recycling; methanol synthesis and synfuels

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**1. Introduction**

Although electric vehicles are the best environmental choice, the high costs and the limited availability of several materials do not allow the total replacement of thermal engines worldwide.

Prompted by the need of meeting the rise in the energy demand and at the same time reducing polluting emissions, the industrialized countries are facing new model of development based on the renewable sources and zero emissions technologies adoption [1–3]. Regarding this, hydrogen is the most abundant element in the universe and it is considered a source of large-scale clean energy, which by 2050 could supply al-

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