



SYNERGY IN SCIENCE:

ENVIRONMENTAL FOR GLOBAL MOVEMENT TO ACHIEVE SDGs October 21", 2020

It is our great pleasure to welcome you to The 2" Sriwijaya International Conference on Environmental Issues 2020 (2rd SRICOENV 2020). The information is available at http://sricoenv.conf.unsri.ac.id. This conference is organized by Graduate Program Universitas Sriwijaya, Indonesia and co-organized by Thai Nguyen University of Agriculture and Forestry, Vietnam; Graz University of Technology, Austria and Academy of Sciences Malaysia, Malaysia. The 2" SRICOENV will be held on October 21", 2020. The objective of SRICOENV is to present the latest state of the arts related to Environmental and Climate Change. This conference provides opportunities exchange new ideas and experiences, to establish all the participants global partners for future collaboration.

Registration link: https://confgate.net/2020/sricoenv

All accepted, registered and presented papers will be published in the SRICOENV 2020 proceedings and will be submitted in IOP Conference Series: Earth and Environmental Science (EES) (Scopus)







KEYNOTE SPEAKERS

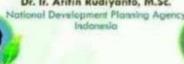




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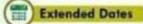


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PREFACE

In the Name of Allah SWT, the Most Gracious, all the praises and thanks be to Him, once more give us the bountiful blessings to establish **Sriwijaya International Conference on Earth Science and Environmental Issue (ICESEI) 2020** formerly known as **The 2nd Sriwijaya International Conference On Environmental Issues 2020 (2nd SRICOENV)** especially in the pandemic Covid-19 which become biggest challenge in all over the world. This conference is organized by Graduate Program Universitas Sriwijaya, Indonesia and co-organized by Thai Nguyen University of Agriculture and Forestry, Vietnam; Graz University of Technology, Austria and Academy of Sciences Malaysia, Malaysia.

The objective of ICESEI 2020 is to perform current state of the arts related to Environmental and Climate Change. All the participants are global partners for future collaboration to exchange new ideas and experiences as their research on "Environment and Climate Change" issue. The conference provides an opportunity for delegations from different institutions to present their ideas and application directly, then build business relationships and research collaborations to create global partnership.

This international conference is a routine agenda of activities at the Graduate Program of Universitas Sriwijaya which initially started in 2018 (1st Sricoenv). Due to Covid-19 pandemic situation which globally occupied, safety and healthiness become priority besides most of traveling and gatherings are strictly prohibited, then the 2^{nd} SRICOENV 2020 is conducted virtually on 21^{st} October 2020.

At this moment, we have to conduct the international conference which flexibly adjusted which expected as the media to extend dissemination process of researchers around the world for their current investigation in the field of Agriculture, Agricultural Technology, Biodiversity, Ecosystem Service and Conservation, Biotechnology and Plant Improvement, Earth Science, Environmental Issue, Forest and Climate Change, Forestry and Environmental Technology, Food Security, Food and Chemical, Soil and Land Science, Food Science, Earth Science, Environmental Science and Environmental Issue. The research results dissemination also hopefully could be known and has positive impact on community.

The Graduate Program of Universitas Sriwijaya as host had holden the ICESEI 2020 from Palembang, South Sumatera-Indonesia. The ICESEI 2020 used ZOOM as platform media. Initially, the presentations are born from keynote speakers for 25-30 minutes each. Then, the ZOOM had split parallelly into four rooms. After that, each room has divided into four sessions. Each speaker has chance to present their research material for 10-15 minutes, then followed by Q&A forums for 15-20 minutes at the end of each session. All questions and answers are delivered directly on ZOOM channel (chat forum). The conference entirely took 9 hours.

We are pleased to inform that the ICESEI 2020 was attended by 200 participants. Those authors and participants came from inside and outside countries such as Austria, Malaysia, Bangladesh, U.S, Japan, Thailand, Philippine, Vietnam, Uganda (9 countries) and various regions in Indonesia (21 of 33 provinces).

The committee selected 63 papers of 94 pre-registered authors, through strict reviewing process to be prepared on publication process. Recently, all the papers have enhanced the quality based on the reviewer's suggestions, to meet the IOP EES requirements.

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On behalf of the Graduate Program of Universitas Sriwijaya, we express our sincere gratitude for the participation of keynote speakers, invited speakers, and all sponsors; the Municipality of Palembang, the Belantara Foundation, BPJS Kesehatan, MKTI, APIKI, Ikadil, Bank Sumsel Babel, BNI, BRI. Furthermore, high appreciation to the whole committee team for their excellence in managed and organized all parts of this conference in pandemic circumstance. We also appreciate publisher to publish the proceedings. We hope people will achieve some important information from this proceeding. We re expecting more and more experts and scholars from all over the world to join this international event next year. We look for more scientists and expertise from everywhere to join on next **3rd Sricoenv**.

Palembang, 21 October 2020 Director of Graduate School Universitas Sriwijaya

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All papers published in this volume of IOP Conference Series: Earth and Environmental Science have been peer reviewed through processes administered by the Editors. Reviews were conducted by expert referees to the professional and scientific standards expected of a proceedings journal published by IOP Publishing.

- Type of peer review: Double Blind
 - a. All papers submitted were checked their similarity index using Turnitin.
 - b. Papers have similarity index more than 25% were rejected.
 - c. After that, the format of the papers was checked. Papers that did not follow the IOP template will be sent back to the authors for revision.
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 - e. Reviewers reviewed the papers and give comments to the papers.
 - f. Scientific committee decided if the papers: accepted, accepted with major revision, accepted with minor revision, or rejected.
 - g. Author revised their papers and send back their revision.
- Conference submission management system:

All papers from the conference submitted using our system where each author must register first and submit article through submission form.

• Number of submissions received:

119 Submission were received.

• Number of submissions sent for review:

94 Submission was sent for review, and the rest was rejected because out of scope, low-quality article and high similarity.

Number of submissions accepted:

63 Paper accepted based on IOP EES Scope and quality

 Acceptance Rate (Number of Submissions Accepted / Number of Submissions Received X 100):

(63/94) x 100 = 67 %

Average number of reviews per paper:

2 times

Total number of reviewers involved:

8 Reviewer Involved + 6 Editors

• Any additional info on review process:

Each reviewer gets 6-7 papers from first

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submission until dateline submission by author (4-5 month), and we give each reviewer MAX 14 days to send back the review result to committee.

• Contact person for queries:

Robbi Rahim, Sekolah Tinggi Ilmu Manajemen Sukma, Medan, Indonesia and University Malaysia Perlis, Malaysia

Email: robbirahim@ieee.org, Whatsapp +62 8126326393

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Accepted papers received: 23 June 2021

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Waste-to-Energy (WTE) Method to Mitigate Harmful Environmental and Health Consequences Due to LDPE Plastic Waste

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Waste-to-Energy (WTE) Method to Mitigate Harmful Environmental and Health Consequences Due to LDPE **Plastic Waste**

Novarini1*, S Kurniawan2, Rusdianasari3, Y Bow4

Abstract. The increase in population accompanied by using LDPE plastic bags in households, traditional markets, and other shopping places impacts increasing LDPE plastic waste. This type of LDPE plastic waste is a problem because it has no sale value then buried in the landfill because of its non-biodegradable nature. So far, the method of decomposing LDPE plastic waste in order to reduce it has been carried out using the incineration method. Gas resulting from combustion in the combustion process causes pollution to the environment and disturbs the health of living things. This problem was solved by using the Waste to Energy (WTE) method, namely pyrolysis. LDPE plastic waste as a feed is converted to fuel oil using 1 unit of pyrolysis equipment by mixing it with a 1% zeolite catalyst at a temperature of 250°C for 6 hours. The volume of the conversion product is measured, and the characteristics of kerosene and diesel fuel are analyzed. The results of the analysis show that the converted fuel oil is a type of kerosene with the amount that can be converted is 1 ml of 1 gram LDPE plastic bag.

1. Introduction

The increase in population in an area impacts many waste products, especially inorganic waste, which causes various kinds of problems, especially problems with the environment. The majority of inorganic waste consists of types of plastic waste that cause environmental damage because it is nonbiodegradable, causing negative impacts on the environment because it cannot be decomposed by microorganisms [1], [2], [3], [4], [5], [6], [7].

Based on its use of plastics can be categorized into seven types. The seven types of plastic are Polyethylene terephthalates (PET), High-Density Polyethylene (HDPE), Polyvinyl Chloride (PVC), Low-Density Polyethylene (LDPE), Polypropylene (PP), Polystyrene (PS), and others. The type of plastic can be seen in Table 1 [8], [9]:

Tabel 1. Types of Plastic

| Type | Common uses |
|--------------------|---|
| PET | Soft drinks, water bottles, containers, salad dressing, biscuit trays, and salad domes |
| HDPE | Shopping bag, freeze bag, bucket, shampoo, milk bottle, ice cream containers, juice bottle and chemical bottle. |
| Polyvynil Chloride | Cosmetic containers, plumbing pipe and fittings, electrical conduct, blister |

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| Type | Common uses |
|---------------------|---|
| (PVC) | packs, wall caldding, roof sheeting, bottles, garden hose, shoes soles, cable sheathing, blood bags, and tubing |
| Low-Density | Refuse bags, irrigation tubing, mulch film, cling wrap, garbage bags, |
| Polyethylene (LDPE) | squeeze bottles. |
| Polypropylene (PP) | Microves dishes, lunch boxes, packaging tape, garden furniture, kettles bottles, ice cream tubs, potatao chip bags and straws. |
| Polystyrene (PS) | CD cases, plastic cutlery, imtation glasswar, low-cost brittle toys, video cases/foamed polystyrene cups, protective packaging, building and food insulation. |
| Other | Automotive and appliance components, computers, electronics, cooler |
| | bottles and packaging. |

Five of these types of plastic except for the type of LDPE plastic waste are taken and sorted by scavengers to be sold in terms of plastic mass, but scavengers do not take the type of LDPE plastic waste because it has no sale value and no plastic collecting agent wants to buy this type of plastic waste. This type of plastic waste from LDPE plastic bags is finally decomposed by incineration. Decomposition of plastic waste by incineration is risky to the environment because pollutants will appear from CO₂, CO, NOx, and SOx exhaust emissions, which cause global warming and destroy the ozone so that other processing methods are needed to plastic processing waste [2], [10], [11], [12]. Other polluting particulates from the combustion of plastics are furans and dioxins. Dioxin substances, if inhaled by humans for a short time, can cause coughing reactions, shortness of breath, and dizziness. In the long term, dioxins can accumulate in the body, causing various cancers because it is carcinogenic [13], [14], [15].

Another condition if plastic waste is not decomposed and carried to water bodies such as rivers and oceans is the formation of microplastics in every natural resource from the oceans such as salt. More than 90% of the salt brands randomly sampled contained microplastics, with the highest source coming from Asia. This microplastic problem not only affects human health as salt consumers but also damages the food chain and all marine biota [16], [17], [18], [19], [20], [22].

Reducing, reusing, incineration, energy recovery, or commonly known as Waste to Energy (WTE), and mechanical recycling are several methods for managing plastic waste. WTE and recycling are two methods that are widely used to convert plastic waste into energy. Pyrolysis is one of the WTE methods that can be applied in processing plastic waste into energy in the form of liquid fuel and char and gas as an alternative to solvent environmental damage due to pollutants [2], [4], [15], [21]. The pyrolysis method is a chemical decomposition process using a temperature of 250°C - 450°C without using air. In this study, we recycled plastic bag waste using the pyrolysis process by taking the best pyrolysis time reference in the related research that the author did previously entitled Analysis of Temperature and Time Against Oil Fuel Results with Plastic Bag Waste Pyrolysis Process, which is 6 hours. However, the use of pyrolysis temperature in this study is the lowest temperature in the previous author's research to minimize energy use by developing a process, namely adding a catalyst, wherein previous studies the pyrolysis process did not use a catalyst. [2].

2. Materials and Methods

LDPE type of plastic waste used is a type of plastic wrap for food is often referred to in the community as plastic bags. Plastic bags are the focus of energy conversion as a solution to environmental and health problems which described in the introduction. The consideration of choosing this type of waste bag because this plastic waste is a contributor to much plastic waste and routinely produced by the community starting from households, markets, and modern shopping centers. Plastic bags are selected into dry waste and wet waste before being processed in the pyrolysis process. Dry

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plastic waste can be used directly while wet plastic waste must be cleaned and dried before it can be used.

The materials in this study were LPDE type plastic waste and 1% natural zeolite catalyst [23]. The equipment in this study is 1 unit of LPG-fueled pyrolysis equipment consisting of a reactor, tar storage, and condenser. The reactor is made of 3 mm thickness stainless steel [24][25], 2.5 kg capacity, 450 mm height, and 320 mm diameter. It is coated with a glasswool to withstand the transfer of heat to the environment. The steel tar reservoir has a height of 200 mm and a diameter of 80 mm. The shell side of the condenser is made of steel with 600 mm height and 350 mm diameter. The tube side is a copper pipe with a diameter of 0.5 in and a length of 5,000 mm, which is formed in a spiral wound. The condenser outlet is a product of fuel oil as the energy produced.

The feeds are 2.5 kg of LDPE plastic waste, and 1% catalyst was introduced from the top of the reactor and heated at a temperature of 250 °C for 6 hours. After 6 hours, the volume of fuel oil condensed from the condenser was measured, and the characteristics of the fuel oil were analyzed, including the cetane index, specific gravity @ 15 °C, viscosity @ 40 °C, sulphur content, flash point, and calorific value to determine the fuel specifications obtained as a product of pyrolysis [15].



Figure 1. LDPE pyrolysis equipment

3. Result and Discussion

3.1. LDPE Fuel Oil from LDPE Plastic Waste Conversion

Fuel oil as a product of the conversion of 2500 ml or 2.5 liters of LDPE plastic waste is shown in Figure 2 below:



Figure 2. Fuel converted from LDPE plastic waste

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LDPE plastic waste conversion for the type of plastic bag as much as 2.5 kg produces 2.5 liters of fuel oil, so every 1 gram of LDPE plastic waste in the type of plastic bag can convert 1 ml of fuel oil. Table 2 shows the results of the analysis of the characteristics of fuel oil from the pyrolysis of LDPE plastic waste.

Table 2. The Results of Pyrolysis Fuel Product Characteristics

| Parameter | Units | Kerosine | Diesel Fuel | Pyrolysis Fuel Oil |
|----------------------------|----------------------|-----------|------------------|---------------------------|
| Cetane index | - | | min 45 | 69 |
| Density @ 15°C | kg/m^3 | max 836 | min 815, max 860 | 779 |
| Sulfur Content | ppm | Max 2,500 | max 500 | 21 |
| Kinematic Viscosity @ 40°C | mm^2/s | | min 2, max 44.5 | 0.61 |
| Flash Point | $^{\circ}\mathrm{C}$ | min 38 | min 52 | 29.2 |
| Caloric Value | MJ/kg | 46.5 | 43.5-55.7 | 27.20 |
| Obtained volume @ 200°C | % Vol | Min 18 | | 91.01 |

The results of the analysis show that the resulting fuel oil product meets kerosene standards except for the aspect of caloric value and flashpoint. Standard specification characteristics have been defined by ASTM Standards, according to Table 2 [27].

4. Conclusions

Environmental problems, pollution, global warming, and health due to the impact of LDPE plastic waste in the plastic bag type can be dissolved by one of the Waste to Energy (WTE) methods, namely the pyrolysis using zeolite catalysts at temperatures of 250 °C for 6 hours. The conversion of LDPE plastic waste produces 1 ml fuel oil for every 1 gram conversion of LDPE plastic waste.

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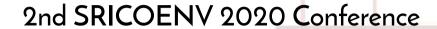












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