Preface

To cite this article: 2022 *IOP Conf. Ser.: Earth Environ. Sci.* **1083** 011001

IOP Conf. Series: Earth and Environmental Science 1083 (2022) 011001 doi:10.1088/1755-1315/1083/1/011001

CABE 2021

International Conference on Climate Change, Agriculture, Biodiversity, and Environtment Study (CABE 2021)

Tarakan, North Kalimantan – Indonesia, 23-24 December 2021

Organized By:

IOP Conf. Series: Earth and Environmental Science 1083 (2022) 011001 doi:10.1088/1755-1315/1083/1/011001

Preface

International Conference on Climate Change, Agriculture, Biodiversity, and Environtment Study (CABE 2021) was held in Tarakan, Indonesia. CABE 2021 was hosted by Biodiversity of Fishery and Marine Center LPPM UBT.

The conference is organized by the Research and Community Services Center of Borneo Tarakan University, Indonesia. The primary objective of The CABE 2021 is to promote effective interaction and cooperation among scientists and technicians who are involved in agriculture research and development in the world with the view of encouraging and facilitating research activity, implementing research findings, sharing of information and publication of research results. The CABE 2021 focuses on both theory, design and applications. In addition to the technical sessions, there will be invited sessions, panel sessions and keynote addresses.

At the moment, we are facing a new situation that has never happened before, the Global Pandemic caused by Coronavirus Disease of 2019 (Covid-2019). This issue has affected the lives of people globally, Including the lives of academics in education. The Covid-19 pandemic is an unprecedented phenomenon for us all. The situation is continually evolving, and we must face new challenges every day. With the appeal above, the International conference on Conference on Climate Change, Agriculture, Biodiversity, and Environtment Study has been switch into virtually mode. Originally the coference was planned in a physical conference. However, until mid-September 2021, the conditions for Covid-19 were not normal. The participants really need the publication results as an annual performance report. In this case, all participants refuse if the conference is postponed. At 23-24 December 2021, all participants were invited virtually for preparation and simulation. In the conference day, all committee were organizing the conference in virtually using zoom application from Tarakan, Kalimantan, Indonesia. The structure were similar with the physical conference as indicated in the following conference program. The keynote speakers session was cunducted in the morning and continued with parallel sessions after lunch break. In the parallel session, each participant was preset their paper for 15 minutes including questions and answers. The CABE 2021 were attended around 170 audience with 121 presenters from academicians, students, scientists, and other related professionals.

Our special thank also goes to all individuals and organizations such as the international program committees (IPC), the conference organizers, the reviewers, and the authors, for their contribution in making CABE 2021 not only a successful international conference but also as a memorable gathering event. We are also grateful for the support of the publication service of IOP. We hope that it should give you a beautiful memory to bring home in addition to new insights and friends gathered during the conference. We are truly grateful for your contribution and interest. We hope that you will get pleasure from CABE 2021 in this beautiful city, Tarakan, Indonesia.

Best regards,
Dr. Ratno Achyani, S.Pi, M.Si (General Chair of CABE 2021)

IOP Conf. Series: Earth and Environmental Science 1083 (2022) 011001 doi:10.1088/1755-1315/1083/1/011001

ORGANIZING COMMITTEE

Advisory Board	: Prof. Dr. Adri Patton, M.Si.
General Chair	: Dr. Ratno Achyani, S.Pi, M.Si
Secretary Chair	: Saat Egra, SP, M.Sc
Co-Secretary Chair	: Dr Heppi Iromo, S.Pi, M.Si : Eny Listiany, S.E : Degi Alrinda Agustina, M.Pd
Technical Program Chair	: Dr. Woro Kusmaryani, M.Pd
Co-Technical Program Chair	: Azlina, S.Pd : Fadli Buyung, S.Pd : Wawan Dinwara
Publication Chair	: Aries Aryadi, S.Hut., M.HP
Co-Publication Chair	: Bambang : Bimo Virgiawan Listanto
Publicity Chair	: Burhanuddin Ihsan S.Pi, M.Sc
Co-Publicity Chair	: Kiki Teguh Gempur Pro Sutejo, S,Pi : Helman S.Pi
Transportation and Equipment Chair	: FerismanTindaon
Co-Transportation and Equipment Chair	: Maret Junaidi : Agus Suryadi, S.E
Finance Chair	: Rica Saridewi Wahyudiyana, S.T., M.A

International Program Committee (IPC)

Ryoung Shin	Riken University of Japan, Japan
Mathias Beck	Bonn University, Germany
SilkeStöber	Universitätzu Berlin. Faculty of Life Sciences, Germany.
Water Leal	Hamburg University of Applied Sciences, Germany.
M. Khais Prayoga	Research Institute For Tea And Cinchona,Indonesia
Keitaro Tawaraya	Faculty of Agriculture, Yamagata University, Japan
DidikIndradewa	Universitas Gadjah Mada, Indonesia
Greet de Jaeger	VIB-Ghent University, Belgium
Reynaldo V. Ebora	Los Banos, Laguna,Philipines
IinHandayani	Murray State University, USA
Carlos Angulo	Bonn University,Germany
Christine Kreye	International Institute of Tropical Agriculture, Nigeria
K. Vijay Krishna Kumar	Acharya NG Ranga Agricultural University, India
Manuel Jose C. Regalado	Philippine Rice Research Institute, Philippines
Panomsak Promburom	Chiang Mai University, Thailand
Rakesh Pandey	Institute of Medicinal and Aromatic Plants, India
Lucky	Bogor Agriculture university, Indonesia
Soottawat	Prince of SongklaUniversity,Thailand
EncengSobari	Politeknik Negeri Subang, Indonesia
Anna AinaRoosda	UIN SunanGunungDjati, Indonesia
Hendrik Santosa	University of Pittsburgh, USA.
Juniarti P. Sahat	Vegetable research center,Indonesia
Elisa Julianti	Universitas Sumatera Utara,Indonesia
I Nyoman Rai	Universitas Udayana, Indonesia
Noman Naseer	Air University, Islamabad, Pakistan.
FerismanTindaon	Universitas HKBP Nomensen, Indonesia
Ivan KristiantoSinggih	Korea Advanced Institute of Science & Technology, Korea
Sandra E.Pakasi	Universitas Sam Ratulangi , Indonesia
Sri HarjatiSuhardi	InstitutTeknologi Bandung, Indonesia
Rosa Tampubolon	Universitas Katolik Santo Thomas, Indonesia
Budi Waluyo	Universitas Brawijaya,Indonesia
LinceRomauliPanataria	Universitas Methodist indonesia,Indonesia

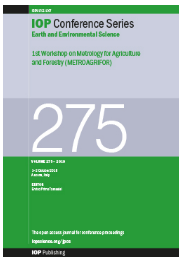
Peer Review Statement

To cite this article: 2022 *IOP Conf. Ser.: Earth Environ. Sci.* **1083** 011002

Peer Review Statement

All papers published in this volume have been 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 Publishing.

- **Type of peer review:** Double Anonymous
- **Conference submission management system:** Edas
- **Number of submissions received:** 191
- **Number of submissions sent for review:** 191
- **Number of submissions accepted:** 121
- **Acceptance Rate (Submissions Accepted / Submissions Received × 100):** 63.4
- **Average number of reviews per paper:** 2
- **Total number of reviewers involved:** 60
- **Contact person for queries:**
  Name: Ristama Simatupang
  Email: ristasmtp79@gmail.com
  Affiliation: Universitas Terbuka Indonesia



The open access *IOP Conference Series: Earth and Environmental Science (EES)* provides a fast, versatile and cost-effective proceedings publication service.

Latest published conferences

Vol 1097 Go

Conference archive

2022 Go

View forthcoming volumes accepted for publication.

If you would like more information regarding *IOP Conference Series: Earth and Environmental Science* please visit conferenceseries.iop.org, and if you are interested in publishing a proceedings with IOP Conference Series please visit our page for conference organizers.

Conference organizers can use our online form and we will get in touch with a quote and further details.

Most read

Latest articles

JOURNAL LINKS

- Journal home
- Journal scope
- Information for organizers
- Information for authors
- Contact us
- Reprint services from Curran Associates

JOURNAL INFORMATION

2008-present
IOP Conference Series: Earth and Environmental Science
doi: 10.1088/issn.1755-1315
Online ISSN: 1755-1315
Print ISSN: 1755-1307

Table of contents

Volume 1083

2022

‹ Previous issue Next issue ›

International Conference on Climate Change, Agriculture, Biodiversity, and Environment Study 22/12/2021 - 24/12/2021 Online

Accepted papers received: 24 August 2022
Published online: 10 October 2022

Open all abstracts

Preface

List Paper CABE 2021

JOURNAL LINKS

Journal home

Journal scope

Information for organizers

Information for authors

Contact us

IOP Conference Series: Earth and Environmental Science

PAPER • **OPEN ACCESS**

The potential of rice bran waste (*Oryza sativa* L.) and shrimp shell waste as chitin nanowhisker with glycerol plasticizer in the production of bioplastic

To cite this article: J V Setiawan *et al* 2022 *IOP Conf. Ser.: Earth Environ. Sci.* **1083** 012045

The potential of rice bran waste (*Oryza sativa* L.) and shrimp shell waste as chitin nanowhisker with glycerol plasticizer in the production of bioplastic

J V Setiawan[1], R Adhitama[1], M T Goeltom[1], T D Askitosari[1], D C Yang[2] and J Sukweenadhi[1*]

[1]Faculty of Biotechnology, University of Surabaya, Surabaya, Indonesia
[2]Graduate School of Biotechnology, Kyung Hee University, Yongin, South Korea

E-mailu; kwee@staff.ubaya.ac.id

Abstract. Bioplastics are plastics made from biopolymers as an alternative to commercial plastics to reduce environmental pollution. Starch from rice bran waste is an essential biopolymer material, and chitin from shrimp shell waste; can be converted into chitin nanowhiskers (CNWs) that can strengthen biopolymer materials. A glycerol plasticizer was added to improve its elasticity. This research aims to determine the potential of starch from rice bran waste and CNWs from shrimp shell waste as ingredients in the production of bioplastics with the addition of glycerol plasticizer and its degradation property through soil burial testing. This fundamental research consists of chitin extraction, CNW production, starch extraction, bioplastic production, tensile strength testing, water uptake testing and soil burial testing on the sand, humus, and compost. The use of rice bran starch and shrimp shell CNW as ingredients in the production of bioplastics are deemed potential. This bioplastic exhibited low mechanical properties such as tensile strength and water uptake but outstanding degradation in the soil burial testing.

Keywords: ***Bioplastics, Biopolymer materials, CNWs, potential of starch.***

1. Introduction

Waste is an unresolved problem in Indonesia. The increase in population and human activities increases the volume of waste. Dependency on plastic materials is caused by activities carried out by humans who use plastic as necessary [1]. In total, the waste production in Indonesia reaches 189-kilo tons per day, much larger than other Southeast Asian countries [2]. Indonesia uses 100 billion plastic bags annually, which places Indonesia as the second-largest plastic user country after China [3].

Synthetic plastic is hard to degrade even though it has been buried completely for decades. The properties of plastic do not decompose naturally, ultimately causing environmental problems [4,5]. One solution is developing environmentally-friendly plastics or bioplastics derived from natural materials. The advantage of bioplastics is that they can decompose naturally quickly and improve soil quality because their decomposition products increase nutrients in the soil [6,7].

So far, bioplastics that have been produced often using starch from cassava [6,8,9], potato [10,11] and corn [12-14] with high starch content and the results are good, but these are non-waste materials that are still widely used by many communities as a main source of food; so, it has caused some disapproval of certain parties [11]. Besides, the technology is not yet widely developed, so production is substantially more expensive than synthetic plastics. In the end, people still chose to use synthetic plastics [15].

Rice bran is considered as a waste because its utilization is still limited, mostly known as a low-quality animal feed ingredient [16,17] and starting to be used as functional food, but obstructed due to the quality of the rice bran which is not standardized [18,19]. Rice bran waste is a suitable raw material in the form of biopolymer for the development of bioplastic [20] to be used as a source of starch which is hydrophilic [21]. Meanwhile, shrimp shells are the biggest pollutant of seafood production [22,23], which contains chitin that can be processed further into nanowhisker chitin (CNW) that functions as an alternative to synthetic reinforcement [24]. CNW can increase the mechanical strength of bioplastics by forming intermolecular hydrogen bonds [25,26]. Meanwhile, hygroscopic glycerol plasticizer functions to give elastic properties, locating between biopolymer bond chains and can interact by forming hydrogen bonds [27,28].

Chitin from shrimp shells is extracted by performing deproteination to remove protein and demineralization to remove minerals [29,30], as it is the most general and simplest method for chitin extraction because sodium hydroxide and hydrochloric acid are easy to procure. Then CNW is produced by performing acid hydrolysis to disperse chitin into rod-shaped particles [31], for it is the most commonly used method, continued by being frozen at -80°C, then freeze-dried to remove excess water in the form of ice by sublimation, following the reference method for which the equipment was readily available. According to a statement from previous research, a specific freezing temperature of -80°C shapes CNW in a sheet-like structure [32]. The CNW was then analyzed with the scanning electron microscope (SEM), the easiest equipment accessible to view its structure.

Starch extraction from rice bran waste is carried out by centrifugation to save time and to ensure all starch settles as pellets rather than by manual precipitation. Distilled water is used in this process because it is easy to obtain, inexpensive, non-toxic, and does not damage the hydrogen bonds in starch [33]. Starch is not soluble in cold water; it can be easily separated [34]. The starch content is then measured by the staining value of the starch-iodine chromogenic complex versus the iodine standard curve and then read at its maximum wavelength [35], for it is the simplest method for the qualitative and quantitative analysis of starch.

Bioplastic production is a physical mixing process where rice bran starch is mixed with CNW, glycerol, distilled water and then heated to undergo gelatinization to produce a gel where the starch-forming bonds form closely together [7]. A high amylopectin content is desirable in starch gelatinization because it makes a lot of space in the starch granules, which utilizes hydrogen interactions between chains that occur. After all, O or H atoms of CNW interact and bond with O and H atoms of starch which consists of amylose and amylopectin [36]. Meanwhile, according to Industrial Research and Consultation Institute in 2016, rice bran contained approximately 14.05% amylose and 21.8% amylopectin [37].

The novelty and contribution of this paper are in the form of fundamental research aimed to investigate the potential of materials that differ from previous methods for the production of bioplastic. The materials used in this research are starch from rice bran waste, integrated with shrimp shells waste in the form of CNW and glycerol plasticizer. Starch from rice bran waste and CNW from shrimp shells waste are still rarely researched individually and have never been integrated into bioplastic production.

2. Material and methods

2.1. Materials

Materials used were shrimp shells from a fresh seafood stall Yeni Putra & Bu Yatmini Gede market in Surakarta, rice bran from a rice mill in Boyolali, pure chitin, pure cassava starch, glycerol, distilled water, demineralized water, hydrochloric acid, sodium hydroxide, iodine reagent, conventional minimarket plastic bag (PM), plastic clip (PC), cassava starch commercial bioplastic bag (PS), humus from Lidah Kota forest in Surabaya, compost from a corn plantation behind Lembah Harapan housing in Surabaya and sand from a construction site in Universitas Surabaya. Equipment used were blender, oven, UV-Vis spectrophotometer, centrifuge, Metrotex MBT 15 – 1000P Bonding tensile tester, magnetic bar, magnetic stirrer, analytical balance, freeze dryer, -80°C freezer, vortex, pH test strips, desiccator, fume hood, watch glass, spoon, pestle, mortar, 100 mesh sieve, a nylon filter, thermometer, beaker glass, filter paper, aluminum foil, glass funnel, pipette, filler, measuring cylinder, falcon tube, cuvette, test tubes and a 16 x 8 cm (2.3 x 1.8 cm) silicone mold.

2.2. Methods

2.2.1. Chitin extraction from shrimp shell waste
Shrimp shells are washed and dried in the sun [29], then crushed and sieved using a 100 mesh sieve to obtain a reasonably uniform shrimp shell powder. Then for deproteination, 90 g of shrimp shell powder was added with 900 mL of 4% sodium hydroxide. The mixture was then heated at 80°C for 1 hour while being stirred constantly. This mixture was cooled off, filtered using filter paper, washed with distilled water until the pH was neutral and then dried in an oven at 60°C for 24 hours. After that, demineralization was carried out by adding the results of the deproteination with 500 mL of 1M hydrochloric acid and constantly stirring at room temperature for 1 hour. The mixture was then filtered using filter paper and washed with demineralized water until the pH was neutral and then dried in an oven at 60°C for 24 hours [38]. The chitin yield was determined as % yield = (dry weight of chitin recovered from extraction x 100) / dry weight of shrimp shells (g) [39].

2.2.2. CNW production.
A total of 15 g of shrimp shell chitin powder was added with 450 mL of 3M hydrochloric acid and was stirred constantly while being heated to boil for 1.5 hours. This mixture was then cooled at room temperature and centrifuged at 4000 rpm for 20 minutes. The supernatant was discarded, while the pellets were taken and washed with demineralized water until the pH was neutral. The washed pellets were then put into plastic clips to be frozen in the freezer at -80°C and then freeze-dried for 48 hours [31,40]. The CNW yield was determined as % yield = (dry weight of CNW recovered from production x 100) / dry weight of chitin (g) [39].

2.2.3. CNW SEM analysis.
SEM analysis was carried out on CNW produced from shrimp shell waste and CNW produced from pure chitin. This analysis was conducted at the Department of Materials and Metallurgy Engineering, Faculty of Industrial Technology and Systems Engineering (FT-IRS), Sepuluh Nopember Institute of Technology (ITS), located on the second floor of the ITS Sukolilo campus, Surabaya, East Java 60111.

2.2.4. Starch extraction from rice bran waste.
500 g of rice bran are added with distilled water and then blended. The result is then filtered and squeezed using a nylon filter to separate the filtrate and dregs. The dregs were discarded, and the filtrate obtained was centrifuged at 4000 rpm for 30 minutes. The supernatant was discarded, while the starch pellets were taken and flattened in a petri dish to be dried in an oven at 40°C for 24 hours [41,42]. The starch yield was determined as % yield = (dry weight of starch recovered from extraction x 100) / dry weight of rice bran (g) [39].

2.2.5. Rice bran starch content analysis.
The rice bran starch content was carried out by mixing 1 mL of the sample solution with 1 mL of iodine reagent. This mixture was then immediately homogenized using a vortex and then added with distilled water until the volume was 50 mL. The sample was then poured into a cuvette, and the absorbance was read using a UV-Vis spectrophotometer at λ 580 nm. The rice bran starch's content was determined using the absorbance read from the sample, put into the equation of the iodine standard curve and multiplied by the dilution factor. The iodine standard curve was made using the same technique, but pure cassava starch solution was used as a standard solution with modifications in several concentrations (20, 10, 5, 2.5, 1.25, 0.625 mg/mL).

2.2.6. Bioplastic production.
The formula to make bioplastics using CNW consist of 2.5 g of rice bran starch, 0.125 g of CNW and 0.625 mL of glycerol are mixed then added with 50 mL of distilled water. This mixture is then heated at 80°C [20] for 20 minutes and constantly stirred [7,41]. 1 mL of the gelatinized mixture is then poured into a 2.3 x 1.8 cm silicone mold, then dried in an oven at 45°C for 20 hours [43]. The same method was then repeated using pure cassava starch and pure CNW for comparison. Pure cassava starch bioplastic without pure CNW is coded as BS, rice bran starch bioplastic without CNW is coded as BB, pure cassava starch bioplastic with pure CNW is coded as BSK, and rice bran starch bioplastic with CNW is coded as BBK.

2.2.7. Tensile strength testing.
PM, PC, PS, BS, BSK, BB and BBK samples measuring 2.3 x 1.8 cm as many as three pieces each for replication were tested for tensile strength using the Metrotex MBT 15 – 1000P Bonding tensile tester. The data results in the form of the distance traveled by the puller from the beginning to the breaking of the samples were recorded [44,45]. Then the tensile strength value of each sample and its replications was then averaged. This test was conducted at PT. Grand Premier Plaspack, located at Jalan Raya Krikilan 436, Dusun Larangan, Krikilan, Kecamatan Driyorejo, Gresik, East Java 61177. Specifically, the tensile strength values of BS with BSK samples and BB with BBK samples were further analyzed statistically with two sample T-test ($P < 0.05$) using Minitab 2018 software to see if there is a significant difference in the tensile strength value by the addition of CNW. The tensile strength values are compared to ASTM D882 – 12 standard for LDPE plastic types.

2.2.8. Water uptake testing.
PM, PC, PS, BSK and BBK samples measuring 2.3 x 1.8 cm as many as three pieces each for replication were weighed initially using an analytical balance and then immersed in distilled water for 1 minute. After, the samples were removed and dried on a tissue for about 15 seconds. These steps were repeated until the samples were destroyed or the sample weight became constant [46]. The water uptake value of each sample was determined as % water uptake = ((final sample weight – initial sample weight) / initial sample weight) (g) x 100 [36]. Each sample's initial weight and final weight and its replications were weighed, put into the % water uptake formula. Each sample's obtained % water uptake and its replications were then averaged. The water uptake values are compared to ASTM D570 – 98 standard for all types of plastic.

2.2.9. Soil burial testing.
PM, PC, PS, BSK and BBK samples measuring 2.3 x 1.8 cm as many as three pieces each for replication were weighed initially using an analytical balance and then wholly buried in 3 types of soil, namely humus, compost and sand, each with a humidity of ±50% and temperature of ±27°C for 15 days. The final sample weight on day 15 was compared with the initial sample weight [47]. The weight loss value of each sample was determined as % weight loss = ((initial sample weight – final sample weight) / initial sample weight) (g) x 100 [48,49]. The initial weight and final weight of each sample and its replications were weighed, put into the % weight loss formula, then averaged the obtained % weight loss of each sample and its replications. Then the % weight loss of each sample was further analyzed statistically with Tukey 5% ($P < 0.05$) using Minitab 2018 software to see if there is a significant difference in the weight loss value of various types of samples in each type of soil. The weight loss values are compared to ASTM 5336 standard for PLA and PCL plastic films.

3. Results and discussion

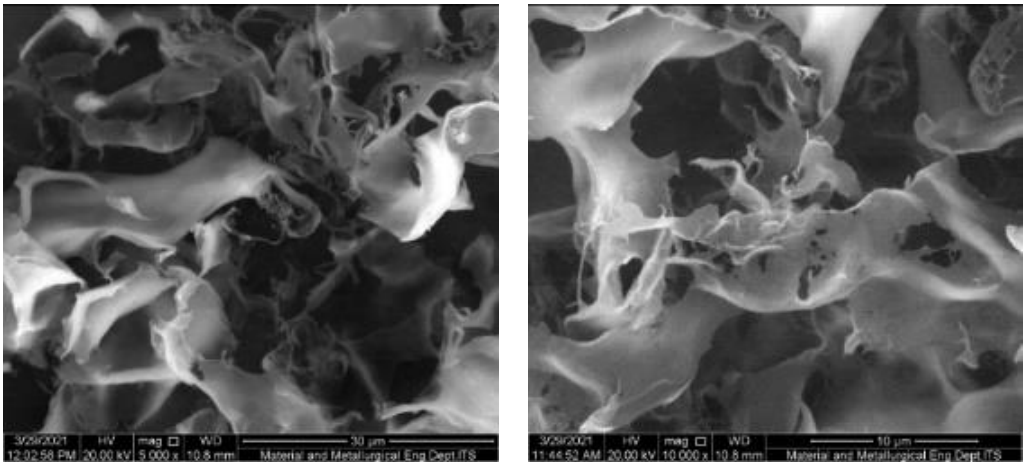
3.1. Chitin extraction from shrimp shell waste and CNW production
From this process, as much as 18.373 g of chitin is obtained from 90 g of shrimp shell with a yield value of 20.414% and a light brown color, as seen in Figure 1. Then, as much as 4.1852 g of CNW is obtained from 15 g of chitin with a yield value of 27.901% and a dark brown color, as seen in Figure 2.

Figure 1. Chitin extracted from shrimp shell waste.

Figure 2. CNW produced from shrimp shell waste chitin.

3.2. CNW SEM analysis

The SEM analysis shows that the CNW produced from shrimp shell waste shows that the structure mainly was random sheets with smooth surfaces, as seen in Figure 3. This result agrees with previous research that states at a freezing temperature of -80°C, the structures formed will be sheet-like.



(a) **(b)**

Figure 3. Magnification of CNW produced from shrimp shell waste, **(a)** 5000 x, **(b)** 10000 x.

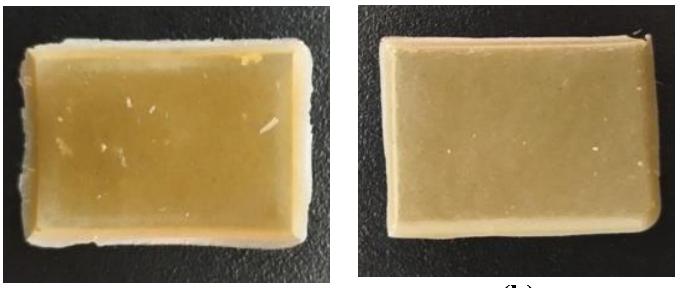
3.3. Starch extraction from rice bran waste

From this process, 87.88 g of starch is obtained from 500 g of rice bran waste with a yield value of 17.576% and a light brown color, as seen in Figure 4.

Figure 4. Starch extracted from rice bran waste.

3.4. Rice bran starch content analysis
Then the rice bran starch's content was calculated using the absorbance read from the sample, which is 0.629, put into the equation of the iodine standard curve, which is $y = 0.1523x + 0.1978$ and multiplied by its dilution factor, which is 10. The starch concentration of rice bran was 28.313 mg/mL.

3.5. Bioplastic production
Bioplastic made from the extracted rice bran starch resulted in brown color and a smooth surface without trapped air bubbles, as seen in Figure 5. The resulting bioplastic also has different surface textures. One side has a rough surface from direct contact with the air because there is no surface barrier, and the other is smooth from direct contact with the mold [16]. The solution formed from the rice bran starch gelatinization was not too dense due to rice bran starch's low amylopectin content.



(a) **(b)**

Figure 5. Extracted rice bran starch bioplastic, **(a)** without CNW produced from shrimp shell waste chitin, **(b)** with CNW produced from shrimp shell waste chitin.

3.6. Tensile strength testing
The results from the tensile strength testing is compared to the ASTM D882 – 12 standard for LDPE plastic types, which is 0.024 MPa. The BS sample met the standard while the BB sample did not, as seen in Table 1. Then from the results of the statistical test of the two sample T-test, it can be seen that there is a significant difference in the tensile strength value of BS with BSK samples and BB with BBK samples due to the addition of CNW. Bioplastic samples that contain CNW showed an increase in tensile strength values up to almost two times compared to samples that did not contain CNW. This result agrees with the statement that the integration of CNW can double the value of tensile strength. When compared again with the ASTM D882 – 12 standard for LDPE plastic types, the BSK sample already met the standard, while the BBK sample still has not met the standard, as seen in Table 1.

Table 1. Data result of tensile strength testing

Sample code	Replication			Tensile strength value (MPa)*
	1	2	3	
PM	0.043	0.043	0.044	$0.043 \pm 1.4\times10^{-4}$
PC	0.044	0.043	0.043	$0.043 \pm 3.8\times10^{-4}$
PS	0.063	0.061	0.062	$0.062 \pm 5.9\times10^{-4}$
BS	0.031	0.030	0.031	$0.031^{a} \pm 2.6\times10^{-4}$
BSK	0.060	0.060	0.061	$0.060^{b} \pm 0.9\times10^{-4}$
BB	0.011	0.010	0.010	$0.011^{a} \pm 4.4\times10^{-4}$
BBK	0.020	0.020	0.021	$0.020^{b} \pm 3.2\times10^{-4}$

*Compared to ASTM D882 – 12 standard for LDPE: 0.024 MPa.
**Averages followed by different notation on BS-BSK sample and BB-BBK sample show significant differences ($P < 0.05$).

PM : conventional minimarket plastic bag

PC : plastic clip
PS : cassava starch commercial bioplastic bag
BS : pure cassava starch bioplastic without pure CNW
BB : rice bran starch bioplastic without CNW
BSK : pure cassava starch bioplastic with pure CNW
BBK : rice bran starch bioplastic with CNW

The tensile strength value of the BBK sample has not met the standard due to the excess addition of plasticizer, which is hygroscopic, resulting in more interactions between the biopolymer molecules. Thus, the bioplastic became too flexible, and its tensile strength value decreased.

3.7. Water uptake testing

The results obtained from water uptake testing show that the BBK sample has low water resistance. That low value is due to the high water-absorbing properties of bioplastics, caused by starch and glycerol, which forms free spaces and increase the mobility of molecules to form hydrogen bonds. Compared with the ASTM D570 – 98 standard for all types of plastic, which is 0.01%, both the BSK and BBK samples did not meet the standard, as seen in Table 2.

Table 2. Data result of water uptake testing.

Sample code	**Replication 1**	**2**	**3**	**Water uptake value (%)***
PM	0	0	0	0 ± 0
PC	0.909	0.917	0.446	0.758 ± 0.516
PS	35.135	33.043	40.271	36.150 ± 2.147
BSK	260.134	242.065	211.451	237.883 ± 14.208
BBK	55.491	58.188	33.368	49.016 ± 7.863

*Compared to ASTM D570 – 98 standard: 0.01%

3.8. Soil burial testing

The weight loss values obtained from the soil burial testing in 15 days show that the BSK and BBK samples had good degradation results in three different soil types. The degradation that occurs is characterized by cracks, leading to damage of small pieces until some are even entirely degraded. Through the Tukey 5% test, it can be seen that there is a significant difference in the weight loss of various types of samples in each type of soil. The BBK sample degraded the best, which was indicated by the high weight loss values in the tested soil types. Compared with the ASTM 5336 standard for PLA and PCL plastic films in 60 days, which is 100%, the BSK and BBK samples both have met the standard, as seen in Table 3.

Table 3. Data result of soil burial testing

Sample code	**Weight loss (%) in 15 days*, ** Sand**	**Humus**	**Compost**
PM	$12.842^{a} \pm 1.493$	$50.593^{a} \pm 20.222$	$36.610^{a} \pm 10.187$
PC	$11.526^{b} \pm 3.579$	$42.963^{b} \pm 20.188$	$33.193^{b} \pm 20.495$
PS	$29.119^{c} \pm 13.604$	$55.549^{c} \pm 8.938$	$44.737^{c} \pm 22.806$
BSK	$10.856^{d} \pm 5.525$	$75.143^{d} \pm 15.623$	$89.432^{d} \pm 10.568$
BBK	$50.714^{e} \pm 5.675$	$86.166^{e} \pm 8.361$	$100^{e} \pm 0$

*Compared to ASTM 5336 standard: 100% in 60 days.
**Averages followed by different notation within the same column show significant differences ($P < 0.05$).

The BBK samples produced had an excellent degradation character in various types of soil due to the humid environment that supports the growth of microorganisms by providing a suitable habitat and the conditions of the sample caused by the hydrophilic nature of starch also the hygroscopic nature of glycerol that accelerates the rate of degradation. There is not much degradation in the sand because it's neither dense nor compact so that water is not retained and evaporates quickly. This causes the sand to be poor in water and microorganisms so that the degradation that occurs in the sample runs slowly compared to other soils [50]. Humus and compost, on the contrary, trigger an excellent degradation evenly because it is rich in various microorganisms and can draw water from the atmosphere [51] because it often rained during the testing period.

4. Conclusion

Based on the results of this research, it was concluded that starch from rice bran waste and CNW from shrimp shell waste has potential as a material for making bioplastics. The bioplastic from this research has been successfully made with a tensile strength value just below the standard; still, the presence of CNW almost doubled its value, compared to without using CNW. This bioplastic also has low water resistance with a water uptake value of 49.016%. And it has an outstanding degradation character in the soil burial testing; within 15 days, it was degraded with a weight loss value of 50.714% in the sand, 86.166% in humus and 100% in compost.

Thus, based on these results, there is an urgent need and a promising opportunity for the use of rice bran waste and shrimp shells waste in the production of bioplastics. Further research, beyond this successful proof of concept, should be able to improve the process, yield, and results – making this an important contribution for the production of bioplastics in the near future.

Acknowledgments

This research was conducted by a grant from the Ministry of Research and Ministry of Education, Culture, Research and Technology, Republic of Indonesia.

References

[1] Fatimura M 2020 *Jurnal Ilmiah Teknik Kimia* **4** 1–7
[2] Kholidah N, Faizal M and Said M 2018 *Sci. Technol. Indones.* **3** 1–6
[3] Ekawati S 2016 *Policy Brief Pusat Penelitian dan Pengembangan Sosial, Ekonomi, Kebijakan dan Perubahan Iklim, Badan Penelitian, Pengembangan dan Inovasi Kementrian Lingkungan Hidup dan Kehutanan* **16**
[4] Wanda. 2019. *Jurnal Online Mahasiswa FISIP.* **6.**
[5] Miraj SS, Parveen N, Zedan HS. 2019. *Int. J. Environ. Health Res.* **31** 788–804.
[6] Logeshwaran V, Sabarinath K, Ishwarya R, Sandhiya S, Kousalya N, Arun P. 2020. *Int. J. Mod. Trends Sci. Technol.* **6** 286–289.
[7] Handayani PA, Wijayanti H. 2015. *J. Bahan Alam Terbarukan.* **4** 21–26.
[8] Sharmiladevi S, Ramesh N, Ramesh S. 2019. *Int. Res. J. Multidiscip. Tech.* **1** 553–559.
[9] Oluwasina OO, Olaleye FK, Olusegun SJ, Oluwasina OO, Mohallem NDS. 2019. *Int. J. Biol. Macromol.* **135** 282–293.
[10] Kasmuri N, Zait MSA. 2018. *Int. J. Eng. Techno.* **7** 110–115.
[11] Arıkan EB, Bilgen HD. 2019. *Int. Adv. Res. Eng. J.* **3** 93–97.
[12] Jethoo AS. 2019. *IOP Conf. Ser.: Mater. Sci. Eng.* **652.**
[13] Tabasum S, Younas M, Zaaem MA, Majeed I, Majeed M, Noreen A, Iqbal MN, Zia KM. 2018. *Int. J. Biol. Macromol.* **122** 969–996.
[14] Ibrahim MIJ, Sapuan SM, Zainudin ES, Zuhri MYM. 2019. *Int. J. Biol. Macromol.* **139** 596–604.
[15] Albuquerque PBS, Malafaia CB. 2018. *Int. J. Biol. Macromol.* **107** 615–625.
[16] Krisnadi R, Handarni Y, Udyani K. 2019. *Pros. Seminar Nasional Sains dan Teknologi Terapan.* **7** 125–130.
[17] Wulandari M, Handarsari E. 2010. *Jurnal Pangan dan Gizi.* **1** 55–62.
[18] Tuarita MZ, Sadek NF, Sukarno, Yuliana ND Budijanto S. 2017. *Jurnal Pangan.* **26.**

[19] Haskito AEP, Setianingrum A, Dameanti FNAEP, Fatmawati M. 2019. *Proc. 6th International Conference on Advanced Molecular Bioscience and Biomedical Engineering.* 117–121.
[20] Alonso-González M, Felix M, Guerrero A, Romero A. 2021. *Int. J. Biol. Macromol.* **188** 932–940.
[21] Estiasih T, Putri WDR, Waziiroh E. 2017. *Umbi-umbian & Pengolahannya.* Malang: UB Press.
[22] Chen X, Yan N. 2015. *Nature.* **524** 155–157.
[23] Tolesa LD, Gupta BS, Lee MJ. 2019. *Int. J. Biol. Macromol.* **130** 818–826.
[24] Mincea M, Negrulescu A, Ostafe V. 2012. *Rev. Adv. Mater. Sci.* **30** 225–242.
[25] Jayakumar R, Prabaharan M, Muzzarelli RAA. 2011. *Chitosan for Biomaterials II – Advances in Polymer Science (POLYMER).* 244.
[26] Yin P, Liu J, Zhow W, Li P. 2020. *Polymers.* **12.**
[27] Yu JG, Yang JW, Liu BX, Ma XF. 2009. *Bioresour. Technol.* **100** 2832–2841.
[28] Purwanti A. 2010. *Jurnal Teknologi.* **3** 99–106.
[29] Dompeipen EJ, Kaimudin M, Dewa RP. 2016. *Majalah BIAM.* **12** 32–39.
[30] Pandharipande SL, Bhagat PH. 2016. *International Journal of Science, Engineering and Technology Research.* **5** 1378–1383.
[31] Pereira AGB, Muniz EC, Hsieh Y. 2014. *Carbohydrate Polymers.* **123** 46–52.
[32] Wu J, Meredith JC. 2014. *ACS Macro Lett.* **3** 185–190.
[33] Wibowo P, Saputra JA, Ayucitra A Setiawan LE. 2008. *Widya Tek.* **7** 113–123.
[34] Ernita L, Riza M, Syaubari. 2020. *J. Rekayasa Kim. Lingkung.* **15** 45–52.
[35] Borkowska M, Bialas W, Kubiak M, Celińska E. 2019. *Appl. Microbiol. Biotechnol.* **103.**
[36] Setiani W, Sudiarti T, Rahmidar L. 2013. *J. Kim. Valensi.* **3** 100–109.
[37] Hildayanti TM, Pangesthi LT. 2017. *e-Journal Boga.* **5** 20–39.
[38] Arbia W, Arbia L, Adour L, Amrane A. 2013. *Food Technol. Biotechnol.* **51** 12–25.
[39] Palacios-Fonseca A J, Castro-Rosas J, Gómez-Aldapa CA, Tovar-Benítez T, Millán-Malo BM, del Real A, Rodríguez-García ME. 2013. *CyTA – J. Food.* **11** 67–74.
[40] Druzian SP, Zanatta NP, Côrtes LN, Streit AFM, Dotto GL. 2019. *Environ. Sci. Pollut. Res.* **26** 28548–28557.
[41] Melani A, Putri D, Robiah. 2019. *Jurnal Distilasi.* **4** 1–7.
[42] Habibah FS, Yasni S, Yuliani S. 2019. *Jurnal Teknologi dan Industri Pangan.* **29** 69–76.
[43] Maryanti E, Pasaribu C, Adfa M, S Yudha SP, Fitriani D. 2016. *Jurnal Teknik Gradien.* **12** 1175–1180.
[44] Sulardjaka J. 2020. *Pengelasan Paduan Aluminium. Yogyakarta: Gadjah Mada University Press*
[45] Nuriyah L, Saroja G, Ghufron M, Razanata A, Rosid NF. 2018. *Natural B.* **4** 177–182.
[46] Intandiana S, Dawam AH, Denny YR, Septiyanto RF, Affifah I. 2019. *EduChemia.* **4** 185–194.
[47] Nichols D. 2004. *Biocides in Plastic.* Shrewsbury: Rapra Technology Limited
[48] Margaretha L, Ratnawulan. 2020. *Pillar of Physics.* **13** 103–112.
[49] Martina SP, Masturi, Yulianti I. 2016. *J. Ilmu Pend. Fisika.* **1** 9–12.
[50] Mostafa HM, Sourell H, Bockisch FJ. 2010. *Agric. Eng. Int. CIGR Journal.* **12** 12–21.
[51] Handayanto E, Muddarisna N, Fiqri A. 2017. *Pengelolaan Kesuburan Tanah.* Malang: UB Press.

Source details

IOP Conference Series: Earth and Environmental Science

Scopus coverage years: from 2010 to Present

Publisher: Institute of Physics Publishing

ISSN: 1755-1307 E-ISSN: 1755-1315

Subject area: Earth and Planetary Sciences: General Earth and Planetary Sciences

Environmental Science: General Environmental Science

Source type: Conference Proceeding

View all documents > Set document alert Save to source list Source Homepage

CiteScore 2021
0.6

SJR 2021
0.202

SNIP 2021
0.409

CiteScore CiteScore rank & trend Scopus content coverage

i Improved CiteScore methodology

CiteScore 2021 counts the citations received in 2018-2021 to articles, reviews, conference papers, book chapters and data papers published in 2018-2021, and divides this by the number of publications published in 2018-2021. Learn more >

CiteScore 2021

$$0.6 = \frac{45{,}063 \text{ Citations 2018 - 2021}}{74{,}324 \text{ Documents 2018 - 2021}}$$

Calculated on 05 May, 2022

CiteScoreTracker 2022

$$0.7 = \frac{49{,}560 \text{ Citations to date}}{71{,}622 \text{ Documents to date}}$$

Last updated on 05 October, 2022 • Updated monthly

CiteScore rank 2021

Category	Rank	Percentile
Earth and Planetary Sciences — General Earth and Planetary Sciences	#153/191	20th
Environmental Science — General Environmental	#191/228	16th

View CiteScore methodology > CiteScore FAQ > Add CiteScore to your site

Scopus Preview

This author profile is generated by Scopus Learn more

Sukweenadhi, Johan

Universitas Surabaya, Surabaya, Indonesia
https://orcid.org/0000-0001-6615-7447

Edit profile   Set alert   Save to list   Potential author matches
Export to SciVal

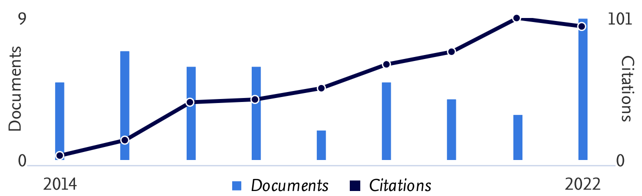
Metrics overview

47
Documents by author

493
Citations by ***450*** documents

13
h-index: View *h*-graph

Document & citation trends



Most contributed Topics 2017–2021

Silver Nanoparticles; Green Synthesis; Biofabrication
3 documents

Adventitious Roots; Cell Suspension; Bioreactor
2 documents

Menaquinone 6; Diaminopimelic Acid; RNA 16S
1 document

View all Topics

47 Documents   Cited by 450 Documents (Beta)   0 Preprints   127 Co-Authors   15 Topics
0 Awarded Grants

Note:

Scopus Preview users can only view an author's last 10 documents, while most other features are disabled. Do you have access through your institution? Check your institution's access to view all documents and features.

Export all   Save all to list   Sort by Date (...

View list in search results format
View references
Set document alert

Review • *Open access*
The state of plant-based food development and its prospects in the Indonesia market
Arwanto, V., Buschle-Diller, G., Mukti, Y.P., ...Purwanto, M.G.M., Sukweenadhi, J.
Heliyon, 2022, 8(10), e11062
Show abstract   Related documents

0
Citations

Review • *Open access*
Chitosan, chitosan nanoparticles and modified chitosan biomaterials, a potential tool to combat salinity stress in plants
Balusamy, S.R., Rahimi, S., Sukweenadhi, J., ...Mijakovic, I., Perumalsamy, H.

4
Citations

Carbohydrate Polymers, 2022, 284, 119189

Show abstract Related documents

Article • *Open access*

Gold Nanoparticles Green-Synthesized by the Suaeda japonica Leaf Extract and Screening of Anti-Inflammatory Activities on RAW 267.4 Macrophages

Kwak, G.-Y., Han, Y., Baik, S., ...Kang, S.-C., Sukweenadhi, J.

Coatings, 2022, 12(4), 460

Show abstract Related documents

0 Citations

Article • *Open access*

Comparative study of polyphenolic compound extraction from empty palm fruit bunches and sugarcane pulp

Putra, L.S., Sukweenadhi, J., Nathania, C., ...Buschle-Diller, G., Marianti Purwanto, M.G.

Heliyon, 2022, 8(2), e08951

Show abstract Related documents

0 Citations

Article • *Open access*

Overexpression of the Panax ginseng CYP703 Alters Cutin Composition of Reproductive Tissues in Arabidopsis

Kim, J., Silva, J., Park, C., ...Lee, K.M., Kim, Y.-J.

Plants, 2022, 11(3), 383

Show abstract Related documents

1 Citations

Review • *Open access*

Valorization of Peel-Based Agro-Waste Flour for Food Products: A Systematic Review on Proximate Composition and Functional Properties

Lesmana, D., Vianney, Y.M., Goenawan, Y.A., ...Erawati, C.M., Purwanto, M.G.M.

ACS Food Science and Technology, 2022, 2(1), pp. 3–20

Show abstract Related documents

0 Citations

Conference Paper • *Open access*

The potential of rice bran waste (Oryza sativa L.) and shrimp shell waste as chitin nanowhisker with glycerol plasticizer in the production of bioplastic

Setiawan, J.V., Adhitama, R., Goeltom, M.T., ...Yang, D.C., Sukweenadhi, J.

IOP Conference Series: Earth and Environmental Science, 2022, 1083(1), 012045

Show abstract Related documents

0 Citations

Conference Paper • *Open access*

Influence of volume medium on growth and ginsenoside level in adventitious root culture of Panax ginseng CA Meyer

Natalie, K., Chandra, S.P., Christanti, P., ...Yang, D.C., Sukweenadhi, J.

IOP Conference Series: Earth and Environmental Science, 2022, 1083(1), 012090

Show abstract Related documents

0 Citations

Conference Paper • *Open access*

The Effect of Beijerinckia fluminensis G3 and Rhizobium pusense G4c on Germination of rice Var. Ciherang and red rice Var. Barak Cenana

Sukweenadhi, J., Sutanto, K., Made Artadana, I.B., Savitri, W.D., Khang, S.C.

IOP Conference Series: Earth and Environmental Science, 2022, 1083(1), 012025

Show abstract Related documents

0 Citations

Article • *Open access*

Scale-up of green synthesis and characterization of silver nanoparticles using ethanol extract of Plantago major L. leaf and its antibacterial potential

Sukweenadhi, J., Setiawan, K.I., Avanti, C., ...Rupa, E.J., Yang, D.-C.

South African Journal of Chemical Engineering, 2021, 38, pp. 1–8

Show abstract Related documents

8 Citations

Back to top

#30 (1570776883): The Potential of Rice Bran Waste (Oryza Sativa L.) and Shrimp Shell Waste Chitin Nanowhisker with Glycerol Plasticizer in the Production of Bioplastic

#30 (1570776883): *The Potential of Rice Bran Waste (Oryza Sativa L.) and Shrimp Shell Waste Chitin Nanowhisker with Glycerol Plasticizer in the Production of Bioplastic*

BibTeX

Property	Change Add	Value
Conference and *track*		**International Conference on Climate Change, Agriculture, Biodiversity, and Environtment Study 2021** - *International Conference on Climate Change, Agriculture, Biodiversity, and Environtment Study 21*
Authors		see table below
Title	Only the chairs can edit	*The Potential of Rice Bran Waste (Oryza Sativa L.) and Shrimp Shell Waste Chitin Nanowhisker with Glycerol Plasticizer in the Production of Bioplastic*
Abstract	Only the chairs can edit	see below
Presenter(s)		Jesica Viona Setiawan
DOI	Only the chairs can edit	
Status		Accepted
Review manuscript		However, authors cannot upload: paper status
Final manuscript	Could upload until Nov 30, 2021 16:28 Asia/Jakarta.	However, authors cannot upload: final deadline
Stamped for attendee proceedings		However, authors cannot upload:

Name	ID	Edit	Flag	Affiliation (edit for paper)	Email	Country
Jesica Viona Setiawan	1916074	not creator		University of Surabaya, Indonesia	s170117052@student.ubaya.ac.id	Indonesia
Johan Sukweenadhi	1917337			University of Surabaya, Indonesia	sukweenadhi@gmail.com	Indonesia
Robert Adhitama	1917506	not creator		University of Surabaya, Indonesia	s170117022@student.ubaya.ac.id	Indonesia

Bioplastics are plastics made from biopolymers that can be easily degraded to become an alternative to commercial plastics to reduce environmental pollution. Waste in rice bran (Oryza sativa L.) contains starch and waste in the form of shrimp shells containing chitin, which can be converted into chitin nanowhiskers (CNWs). In the production of bioplastics, starch is a essential material in the form of biopolymer and CNW can strengthen biopolymer materials. Starch-based bioplastics have the characteristics of low mechanical properties, so that it is necessary to add a plasticizer, namely glycerol. This research aims to determine the potential of starch from rice bran waste and CNWs from shrimp shell waste as ingredients in the production of bioplastics with the addition of glycerol plasticizer and its degradation property through soil burial testing. This research consists of extracting chitin from shrimp shell waste, producing CNWs along with its SEM analysis, extracting starch from rice bran waste and analyzing its starch content, bioplastics making an experiment, tensile strength testing, water uptake testing and soil burial testing on three types of soil, namely sand, humus, and compost. The use of rice bran starch and shrimp shell CNW as ingredients in the production of bioplastics are deemed potential. Experimental formulation with 2.5 g of rice bran starch, shrimp shell CNW 5% (w/w) of starch weight and glycerol 25% (w/w) of starch weight was proven to produce bioplastic. This bioplastic exhibited mechanical properties such as tensile strength with a value of 0.02 MPa and a water uptake value of 49.016%. The bioplastics formed exhibited (bio)degradable property in the 15 days of soil burial testing with weight loss values of 50.714% in the sand, 86.166% in humus, and 100% in compost.

Document (show)	Pages	File size	Changed
PDF	9	678,237	Nov 14, 2021 10:35 Asia/Jakarta

Personal notes

You are an author for this paper. You have authored an accepted paper.

Reviews

2 Meta Reviews

Review 1

Originality	Significance of Topic	Presentation	Recommendation
Weak Accept (6)	Weak Accept (6)	Neutral (5)	Weak Accept (7)

Strengths/Weakness (What are the major reasons to accept/reject the paper? [Be brief.])

Strengths/Weakness:
-The paper format is out of IOP style, it must be revised
-English paper must be proofread
-the introduction must be supported by the results of research from the latest literature at least the last 3 years. The current literature are too old.
-Explain what the advantages of the proposed method of previous research in the introduction.
-Show the contribution of this paper by explaining the differences between the proposed method and the methods in the literature

Contribution/s & Detailed comments (What are the major issues addressed in the paper? Do you consider them important? Comment on the degree of novelty, creativity and technical depth in the paper. Please provide detailed comments that will be helpful to the TPC for assessing the paper, as well as feedback to the authors.)

Contribution/s & Detailed comments:
-The paper structure need for improvement
-Each equation must be numbered in the text
-Explain how the data were obtained and processed in the method section.
-The discussion must be revised by remove literature study into Introduction
-References format must be revised
-All papers submitted to the CABE 2021 must be written in English and formatted in the standard of the publisher format (All regular papers are limited to about six (6) to ten (10) pages

Review 2

Originality	Significance of Topic	Presentation	Recommendation
Neutral (5)	Weak Accept (6)	Neutral (5)	Neutral (6)

Strengths/Weakness (What are the major reasons to accept/reject the paper? [Be brief.])

Strengths/Weakness:
-The references must contain papers from reputable international journals and conferences.
-The introduction section must contain at least 7 updated references which are published within the last 3 years (i.e., publication year 2018 to 2021).
-Should not use literature studies in the results and discussion
-The references is to follow the IOP citation style.
-References must be listed in order of appearance.
-Sources listed in the references must be used at least once in the paper.
-References must be written in international languages, expect those who are authored by the authors themselves.

Contribution/s & Detailed comments (What are the major issues addressed in the paper? Do you consider them important? Comment on the degree of novelty, creativity and technical depth in the paper. Please provide detailed comments that will be helpful to the TPC for assessing the paper, as well as feedback to the authors.)

-Contribution/s & Detailed comments:
The introduction must be improved with supported by literature review from the reputable international journal which published in the last three years. Related works should explain what other researchers have recently done related to the topic that exterminated.
-All papers submitted to the CABE 2021 must be written in English and formatted in the standard of the publisher format (All regular papers are limited to about six (6) to ten (10) pages