



## Digital Receipt

This receipt acknowledges that Turnitin received your paper. Below you will find the receipt information regarding your submission.

The first page of your submissions is displayed below.

Submission author: Rifda Naufalin  
Assignment title: Prof Rifda Naufalin  
Submission title: Naufalin\_2021\_IOP\_Conf.\_Ser.\_E...  
File name: 21\_IOP\_Conf.\_Ser.\_Earth\_Environ...  
File size: 611.7K  
Page count: 8  
Word count: 3,233  
Character count: 16,805  
Submission date: 15-Feb-2021 02:32PM (UTC+0700)  
Submission ID: 1509886281

IOP Conference Series: Earth and Environmental Science

**PAPER • OPEN ACCESS**

Antioxidant activities, physicochemical properties and sensory characteristics of kecombrang tea (*Etlingera elatior*) as functional drink

To cite this article: R Naufalin et al 2021 IOP Conf. Ser.: Earth Environ. Sci. 653 012129

View the [article online](#) for updates and enhancements.

The 17th International Symposium on Solid Oxide Fuel Cells (SOFC-XVII)  
DIGITAL MEETING • July 18-23, 2021  
EXTENDED Abstract Submission Deadline: February 19, 2021  
**SUBMIT NOW** →

This content was downloaded from IP address 103.9.22.67 on 10/02/2021 at 03:10

Naufalin\_2021\_IOP\_Conf.\_Ser.\_  
\_Earth\_Environ.\_Sci.\_653\_0121  
29\_Prof Rifda  
*by* Rifda Naufalin

---

**Submission date:** 15-Feb-2021 02:32PM (UTC+0700)

**Submission ID:** 1509886281

**File name:** 21\_IOP\_Conf.\_Ser.\_Earth\_Environ.\_Sci.\_653\_012129\_Prof\_Rifda.pdf (611.7K)

**Word count:** 3233

**Character count:** 16805

PAPER • OPEN ACCESS

## Antioxidant activities, physicochemical properties and sensory characteristics of kecombrang tea (*Etlingera elatior*) as functional drink

To cite this article: R Naufalin *et al* 2021 *IOP Conf. Ser.: Earth Environ. Sci.* **653** 012129

View the [article online](#) for updates and enhancements.

The 17th International Symposium on Solid Oxide Fuel Cells (SOFC-XVII)

DIGITAL MEETING • July 18-23, 2021

EXTENDED Abstract Submission Deadline: February 19, 2021



**SUBMIT NOW →**

## Antioxidant activities, physicochemical properties and sensory characteristics of kecombrang tea (*Etilingera elatior*) as functional drink

R Naufalin<sup>1\*</sup>, Erminawati<sup>1</sup> and D N Wibowo<sup>2</sup>

<sup>1</sup> Department of Food Science and Technology, Faculty of Agriculture, Jenderal Soedirman University

<sup>2</sup> Faculty of Biology, Jenderal Soedirman University Jl. Dr. Soeparno 61 Purwokerto 53123 Central Java Indonesia

Corresponding author: rifda.naufalin@unsoed.ac.id

**Abstract.** Kecombrang is one of the plants in *Zingiberaceae* group which has antioxidant properties and potential to be processed as raw material for functional drinks including herbal teas. The addition of sugar and tamarind can alter the characteristics of kecombrang tea. The purpose of this study was to determine the effect of adding various types of sugar and tamarind to kecombrang flower powder on physicochemical properties, antioxidant activity and sensory characteristics of kecombrang tea. This study used an experimental method with a randomized block design (RBD) consisted of 6 treatment combinations with 4 replications to obtain 24 experimental units. The factors tested were kecombrang plant parts (flowers and fruit); tamarind addition (without and added with acid); and crystal coconut sugar addition (without and added with coconut sugar). The results showed that the best treatment combination based on the effectiveness index method was kecombrang flowers with the addition of tamarind and coconut sugar. This product has a total phenol of 5.96 mg TAE (Tannic Acid Equivalent)/gram bk, water content of 1.32%, ash content of 3.54%, pH of 4.5, and antioxidant activity of 85.93%, red color, a quite strong distinctive aroma of kecombrang, and a bit sour taste.

### 1. Introduction

Tea is the most consumed beverage in the world, an infusion made by brewing leaves, shoots, or dried leaf stems from *Camellia sinensis* with hot water [1]. Tea are popular because they are well known and has amazing taste. In addition, tea has also long been believed to have properties for health. Its influence on health is known from various studies mainly due to the content of tea flavonoids which have antioxidative properties and play a role in fighting free radicals [2].

Tea divided into two groups, namely herbal and non-herbal teas. Non-herbal teas are grouped again into three groups, namely black tea, green tea, and oolong tea. Herbal tea is a general term used for drinks that do not originate from tea plants, *Camellia sinensis*. Herbal teas are made from the processing of flowers, seeds, leaves, or roots of various plants.

Kecombrang is a member of *Zingiberaceae* group that is widely used by the community as vegetables and medicines. Kecombrang is also used as medicine related to its efficacy as an antioxidant. The antioxidant content of the kecombrang flower is known to originate from flavonoids and derivatives. The presence of flavonoid components in kecombrang flowers, which are also found in *Camellia sinensis*



Content from this work may be used under the terms of the [Creative Commons Attribution 3.0 licence](https://creativecommons.org/licenses/by/3.0/). Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.

Published under licence by IOP Publishing Ltd

tea, causes kecombrang to have great potential to be processed as raw material for functional drinks so that it can be used as an ingredient in making herbal teas.

Basically, Kecombrang has a taste that is strong and less preference by the public. The results of Molerman and Rossi [3] study on the effect of adding kecombrang flowers to the acceptability and nutrient content of crackers, showed that kecombrang crackers had flat taste after consumption. It is caused by the presence of polyphenol compounds in kecombrang flowers. So in its processing, kecombrang tea needs to be added with sweeteners and other additives so that it can be accepted by consumers.

The purpose of this study was to determine the combination of blanching, fermentation and proper drying time to produce kecombrang tea with the best antioxidant activity, chemical components, physicochemical and organoleptic characteristics.

## 2. Research methodology

### 2.1. Materials

The ingredients used in this study included kecombrang obtained from Kutayasa Village, Sumbang Baturaden Subdistrict, crystal coconut sugar obtained from Unsoed LPPM, granulated sugar obtained from the Aroma store, Tamarind (*Tamarindus indica* L.) which obtained from the Purwokerto wage market, and chemicals for analysis include ethanol pa, methanol pa, 10% Folin ciocalteu reagent, NaHCO<sub>3</sub>, tanic acid, DPPH (1,1-diphenil-2- pycrilhidrazil), and distilled water. Tools used included cabinet dryers, milling machines (Phillips), ovens (Memmert), furnaces (Thermolyne 1000), UV spectrophotometers (1800 Shimadzu, Japan), analytical scales, 80 mesh sieves, aluminum foil, thermometers, spatulas, porcelain dishes, and glassware (Pyrex, Germany) including erlenyemeyer tubes, test tubes, measuring cups, and measuring pipettes.

### 2.2. Experimental design

The study was conducted experimentally using a Randomized Block Design (RBD) arranged in factorial. The factors consisted of 3 factors, kecombrang plant parts, namely flowers and fruit; addition of 1% tamarind, namely without and addition of acid; and the addition of crystal coconut sugar, namely without and the addition of coconut sugar.

The variables observed in this study include chemical variables, namely total phenol, water content and ash content, physicochemical variables, namely pH, antioxidant activity variables and sensory variables which include color, aroma, sweetness, sour taste and preference. The data obtained from the results of the study were analyzed using a variety of analysis (t test) at the level of 5% and if the results of the analysis showed a real effect, then followed by a regression test and multiple appeal tests. Sensory test data were analyzed by a non-parametric test (Friedman Test) and if there was an effect of treatment, it was followed by a double comparison test.

## 3. Results and discussion

### 3.1. Total phenol

The results of the analysis of variance showed that the addition of tamarind and coconut sugar had a significant effect on the total phenol of kecombrang tea. The average total phenol value of kecombrang tea with various treatments is shown in Figure 1.

The highest total phenol was shown in the kecombrang tea treatment using the kecombrang flower with the addition of tamarind and coconut sugar (5.88 mg TAE / gram bk) while the lowest total phenol was shown in the kecombrang tea, the kecombrang fruit added 1% tamarind without the addition of coconut sugar (4,14 mg TAE/gram bk).

Tea made from kecombrang flower parts has a higher total phenol. According to Pertiwi et al. [4], kecombrang flower powder contains phenols, steroids, triterpenoids, alkaloids and glycosides. These compounds also affect the highest total phenol of kecombrang tea. The addition of tamarind and coconut

sugar can increase the total phenol content of kecombrang tea. This is due to the synergistic interaction between the compounds contained in kecombrang, tamarind and coconut sugar. Wang et al. [5] explained that each food ingredient has different bioactive compounds with varying antioxidant capacities. When these ingredients are consumed together, the total antioxidant capacity of the mixture of ingredients can change through synergistic and additive effects between the components, which alter their physiological impact. The addition of coconut sugar produces kecombrang tea with a higher total phenol. This is supported by the results of total phenol testing of ingredients where coconut sugar which has a total phenol content of 1.72 mg TAE / gram.

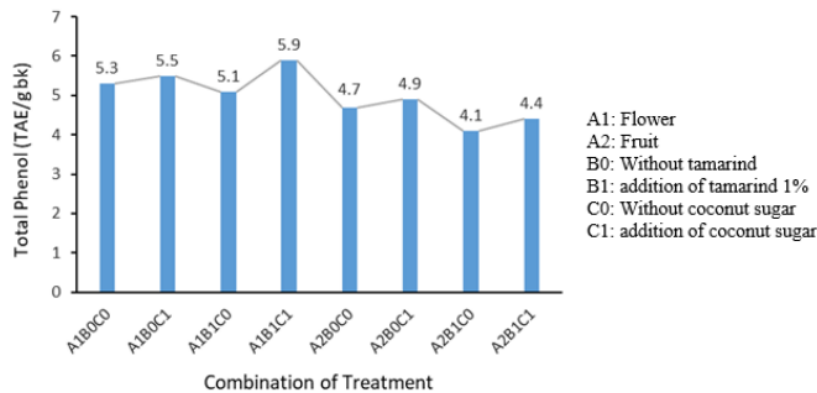


Figure 1. Average total phenol value of kecombrang tea in various treatments

3.2. Water content

The results of the analysis of variance showed that the tea formulated from the kecombrang plant part with the addition of tamarind and coconut sugar had an effect on the water content of the kecombrang tea. The average water content of kecombrang tea with various treatments is shown in Figure 2.

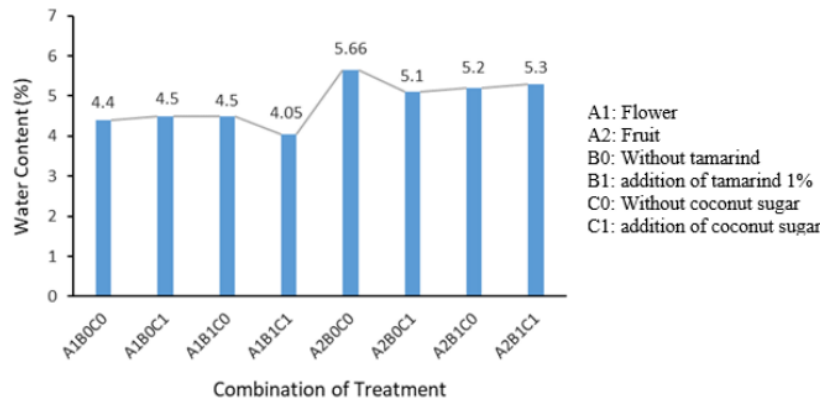


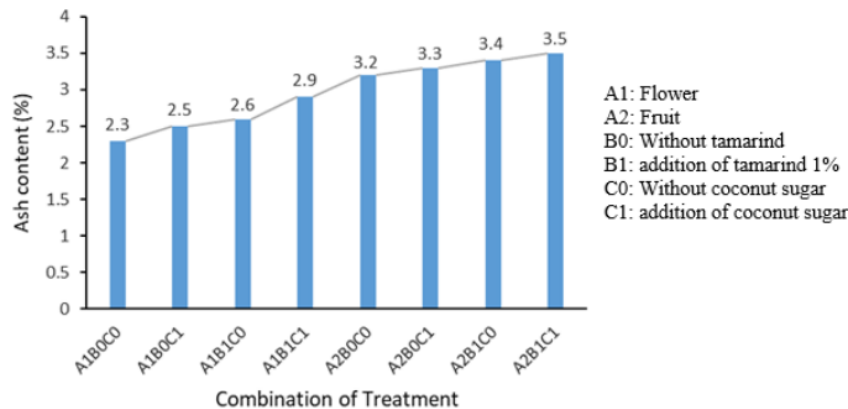
Figure 2. The average value of kecombrang tea water content in various treatments

Based on Figure 2, it can be seen that the treatment of adding kecombrang flower parts with the addition of 1% tamarind and coconut sugar provides the lowest water content, namely 4.05%, while the highest water content is found in the treatment of kecombrang fruit without the addition of tamarind and without the addition of coconut sugar, namely 5.64 %. This is because kecombrang flower powder has a lower water content than kecombrang fruit powder [6].



### 3.3. Ash content

The analysis of variance showed that the proportion of kecombrang with tamarind and coconut sugar affected the ash content of the resulting kecombrang tea. The average value of the ash content of kecombrang tea with various treatments is presented in Figure 3.



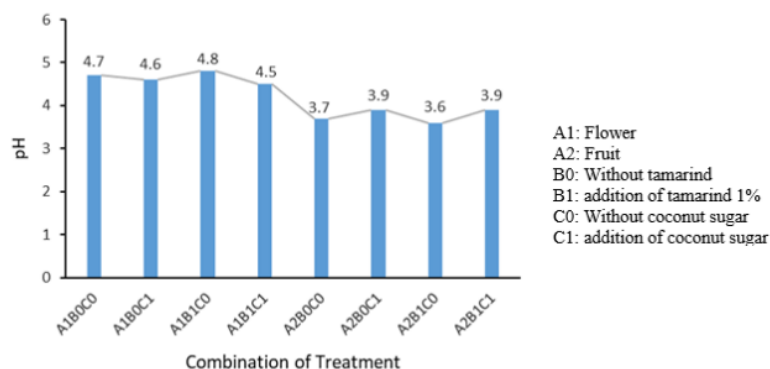
**Figure 3.** The average value of the ash content of kecombrang tea in various treatments

The average value of the ash content of kecombrang tea with kecombrang flower as raw material, the addition of tamarind and coconut sugar was higher than the tea made from kecombrang fruit as raw material. Wijekoon et al. [7] explained that kecombrang contains several minerals including calcium, copper, iron, magnesium, manganese, zinc, sodium, potassium, sulfur, phosphorus, boron, fluorine, selenium, cobalt, chromium, and molybdenum. Kecombrang tea with the addition of coconut sugar has a higher ash content compared to kecombrang tea which is given without the addition of coconut sugar. This is because coconut sugar contains more minerals. According to Sembiring [8], the ash content of coconut sugar ranges from 1.98% - 2%.

### 3.4. pH value

pH is the degree of acidity used to express the level of acidity or presence of a solution. The results of the analysis of variance showed that the addition of tamarind (A) and sugar significantly affected the pH value of the product. The pH value of kecombrang tea on the interaction of kecombrang plant parts, the addition of tamarind and sugar is shown in Figure 4.

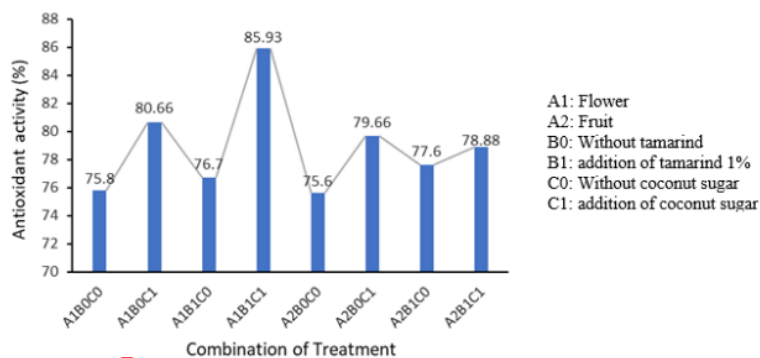
Based on Figure 4, the lowest pH value is shown by the treatment of kecombrang fruit, the addition of 1% tamarind is 3.75, while the highest pH value is the treatment of kecombrang flowers with the addition of coconut sugar which is 4.87. The pH value in this range indicates that the product has a fairly high level of acidity. This acidity level is thought to be caused by the presence of organic acids contained in kecombrang flowers and fruit. Kecombrang tea with the addition of 1% tamarind resulted in a lower pH value than kecombrang tea without the addition of tamarind. The decrease in pH value is influenced by the acidity of kecombrang and tamarind. Both of them have H<sup>+</sup> ions which can provide a lot of acid, the greater the H<sup>+</sup> ions released, thus lowering the pH value. Tamarind pulp contains tartaric acid, malic acid, citric acid, succinic acid, acetic acid, pectin, and invert sugar [9]. The pH value of kecombrang tea with the addition of coconut sugar is higher than that of kecombrang tea without the addition of sugar. The addition of coconut sugar to the steeping of kecombrang tea significantly reduces acidity. This is presumably because the pH value of coconut sugar is neutral, namely 6.5 to 7.



**Figure 4.** The average pH value of kecombrang tea in various treatments.

### 3.5. Tea brew Antioxidant activity

The value of antioxidant activity of kecombrang tea in the tea formula of kecombrang flowers and fruit with the addition of tamarind and coconut sugar is shown in Figure 5.



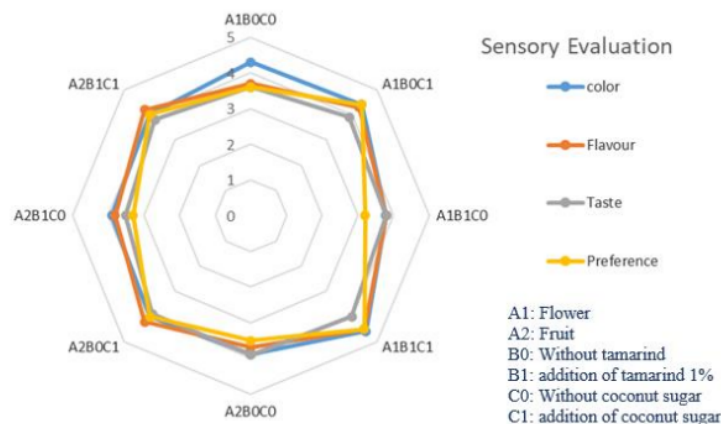
**Figure 5.** The average value of the antioxidant activity of kecombrang tea in various treatments

The results of the analysis of variance showed that the kecombrang formulation with the addition of tamarind and sugar had a significant effect on the antioxidant activity of the kecombrang tea brew. The average value of antioxidant activity for kecombrang tea ranged from 75.45% - 85.59%. Kecombrang flower is the main ingredient used in making kecombrang tea which acts as the biggest antioxidant contributor to the product. This is consistent with research conducted by Pambudi [10] which states that the inhibition of free radical activity increases with increasing concentrations so that more antioxidant compounds donate electrons to free radicals and cause more free radical molecules that are unreactive and unstable. The antioxidant activity of kecombrang tea with the addition of tamarind was higher than without the addition of tamarind. It is suspected that pH affects the antioxidant activity of kecombrang tea. The pH of the tea brew of kecombrang with the addition of tamarind is lower than the pH of tea brew of kecombrang with the addition of coconut sugar. The results of the research by Naufalin [11] and Putri et al. [12] showed that the phenol component in kecombrang flowers was more active at low pH. This is supported by Borman and Deans [13] and Puupponen [14] which states that phenolic compounds found in plants are more effective at low pH. The structure of the phenolic compound hydroxyl group plays an important role in antioxidant activity.



### 3.6. Sensory variable

The average value of the sensory tea brew of kecombrang is presented in the form of web spiders, which can be seen in Figure 6.



**Figure 6.** Spider web score of the average sensory steeping variable of kecombrang tea in various combinations of treatments.

**3.6.1. Color.** The results of Friedman analysis showed that the treatment given had a very significant effect on the color of the kecombrang tea brew. The color produced by brew the kecombrang tea treatment was 4.57 (brown) and had a higher intensity than the kecombrang tea brewing treatment, namely 1.00 (pink). Basically, the color of kecombrang tea is influenced by the ingredients of kecombrang and the addition of sugar. The pink to red color is caused by the natural color of the kecombrang flower, which is reddish, this reddish color comes from the antocyanin pigment contained in kecombrang. Meanwhile, the brown color in kecombrang tea is influenced by coconut sugar. Naufalin and Rukmini [15] explains that coconut sugar has a distinctive brownish color due to the maillard reaction and caramelization during the processing process, which is caused by the presence of reducing sugars, proteins and fats in sap.

**3.6.2. Aroma of kecombrang.** The results of the analysis of variance showed that the addition of tamarind and kecombrang plant parts with sugar did not affect the aroma of the kecombrang tea. The average value of kecombrang aroma resulting from the scoring test is in the range of 2.90 - 3.48 which means it is rather strong. Aroma relates to the volatile components of a material. The components of spices are volatile or volatile. The components that play a role in the formation of aroma are essential oils. Kecombrang is reported to contain essential oil of 0.4% (v / w). The essential oil in kecombrang powder is dominated by alcohol (29.4%) and esters (22.6%) [4]. The treatment of using flowers and fruit, adding tamarind, and coconut sugar produced a rather strong aroma in kecombrang tea.

**3.6.3. Sour taste.** The results of Friedman analysis showed that the treatment given had a very significant effect on the sour taste of kecombrang tea. Panelists' assessment of sour taste was in the range of 2.26 - 3.53 (slightly acidic). The sour taste in kecombrang tea is caused by the presence of organic acids contained in kecombrang. The addition of tamarind to the product also lowers the pH value thereby increasing the acidity of the product. Rukmana [16] explains that tamarind pulp contains 8-14% tartaric acid, 30-40% sugar, and a small amount of citric acid and potassium bitaetrate so that it tastes very sour.

In a sour taste, the sour sensation is influenced by the ion concentration ( $H^+$ ) in the solution which results in a low pH value of the product

**3.6.4. Preferences.** The level of preference shows the overall acceptance of the panelists for the sensory attributes of the product being tested. Panelists average rating of the level of preference for kecombrang tea was in the range of 2.90 - 3.66 (dislike - like). The average value of the level of preference is influenced by various factors, including taste, aroma and color. These factors will give a rise to an overall acceptance for the degree of preference of tea.

#### 4. Conclusion

The best treatment combination based on the effective index method is the treatment was kecombrang tea with kecombrang flowers with the addition of tamarind and coconut sugar. This product has a total phenol of 5.96 mg TAE (Tannic Acid Equivalent) / gram bk, water content of 4,05%, ash content of 2.05%, pH of 4.5, and antioxidant activity 85.93%, and sensory evaluation have reddish brown color, distinctive aroma of tea, fresh taste, and preferred by panelists.

#### Acknowledgments

The authors thank to DRPM DIKTI in Applied research scheme 2020 who has provided funds and facilities for this research and all parties who have helped to make it happen this research.

#### References

- [1] Arts I C, van De P B and Hollman P C H 2000 *J. Agric. Food Chem.* **48** 1752–7
- [2] Naufalin, R. 2020. *Kecombrang sebagai sumber sediaan antioksidan alami pada produk pangan*. UNSOED Press. Purwokerto
- [3] Molerman H N and Rossi E 2014 *JOM FAPERTA UNRI* **1** 1–11
- [4] Pertiwi D I, Naufalin R, Arsil P, Erminawati, Wicaksono R and Auliya T 2019 *IOP Conference Series: Earth and Environmental Science* **406** 012008
- [5] Wang S, Meckling K A, Marcone M F, Kakuda Y and Tsao R 2011 *J. Agric. Food Chem.* **59** 960–8
- [6] Naufalin R and Herastuti S R 2017 *International Food Research Journal* **24** 379–85
- [7] Wijekoon J O M M, Karim A A and Bhat R 2011 *International Food Research Journal* **18** 1415–20
- [8] Sembiring 2009 *Pengaruh Kadar Air Bubuk Teh Hasil Fermentasi* Bachelor Thesis (Medan: Universitas Sumatera Utara)
- [9] Soedibyo M 1998 *Alam Sumber Kesehatan Manfaat dan Kegunaan* (Jakarta: Balai Pustaka) pp 31–60
- [10] Pambudi J 2000 *Prosiding Seminar Teh untuk Kesehatan* (Bandung: Pusat Penelitian Teh dan Kina Gambung)
- [11] Naufalin R 2019 *AIP Conference Proceedings* **2094** 020032
- [12] Putri F A, Naufalin R and Wicaksono R 2019 *IOP Conference Series: Earth and Environmental Science* **250** 012056
- [13] Dorman H J D and Deans S G 2000 *J. App. Microbiol.* **88** 308–16
- [14] Puupponen P R 2001 *J. Appl. Microbiol.* **90** 494–507
- [15] Naufalin R and Rukmini H S 2018 *IOP Conference Series: Earth and Environmental Science* **102** 012035
- [16] Rukmana R 2005 *Budidaya Asam Jawa* (Yogyakarta: Kanisius)

ORIGINALITY REPORT

---

<b>19%</b>	<b>11%</b>	<b>16%</b>	<b>%</b>
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

---

MATCH ALL SOURCES (ONLY SELECTED SOURCE PRINTED)

---

13%

★ R Naufalin, E Sutrisna, R Wicaksono. "Antioxidant potential ingredient of kecombrang plants (Etlingera elatior)", IOP Conference Series: Earth and Environmental Science, 2021

Publication

---

Exclude quotes On

Exclude bibliography On

Exclude matches < 1%