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A Comparison of Organic Cement Made from Recycled Waste Material and Portland Cement.

Engineering, Technology & Applied Science Research
ISSN : 1792-8036

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(Publish – 2021)

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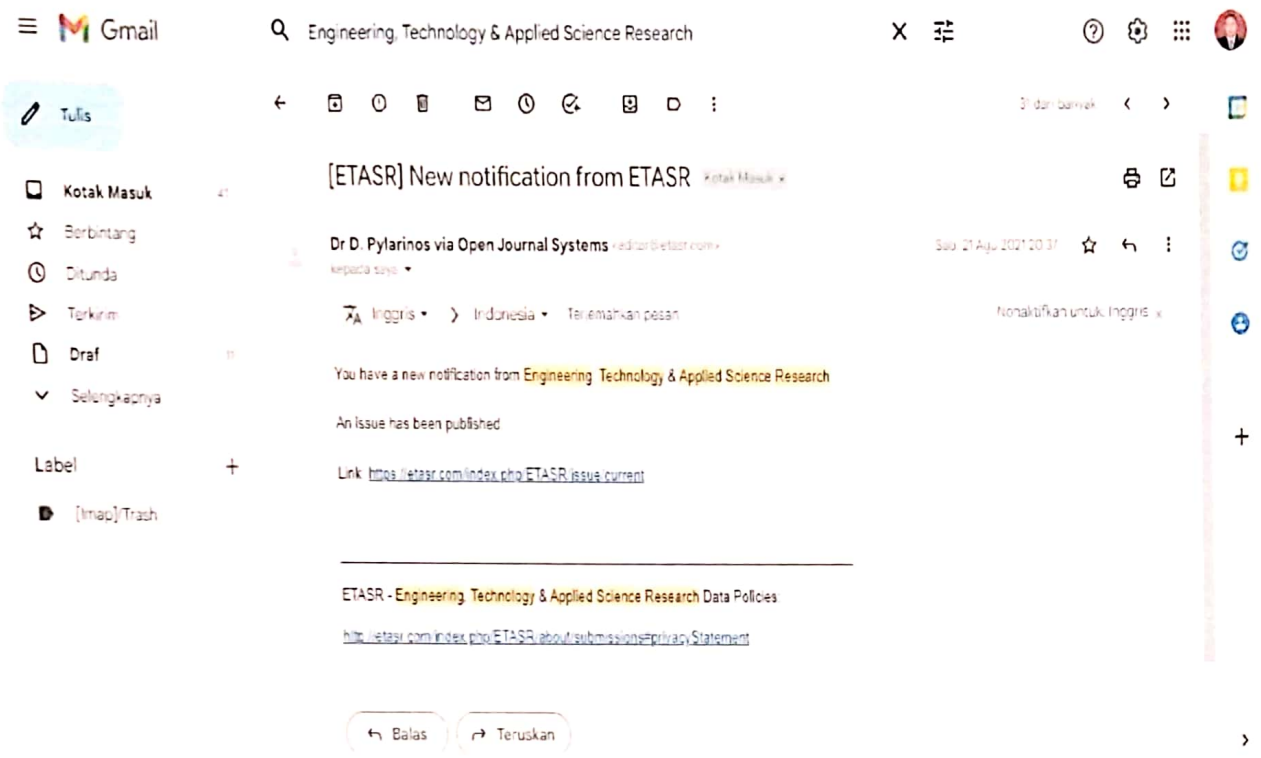

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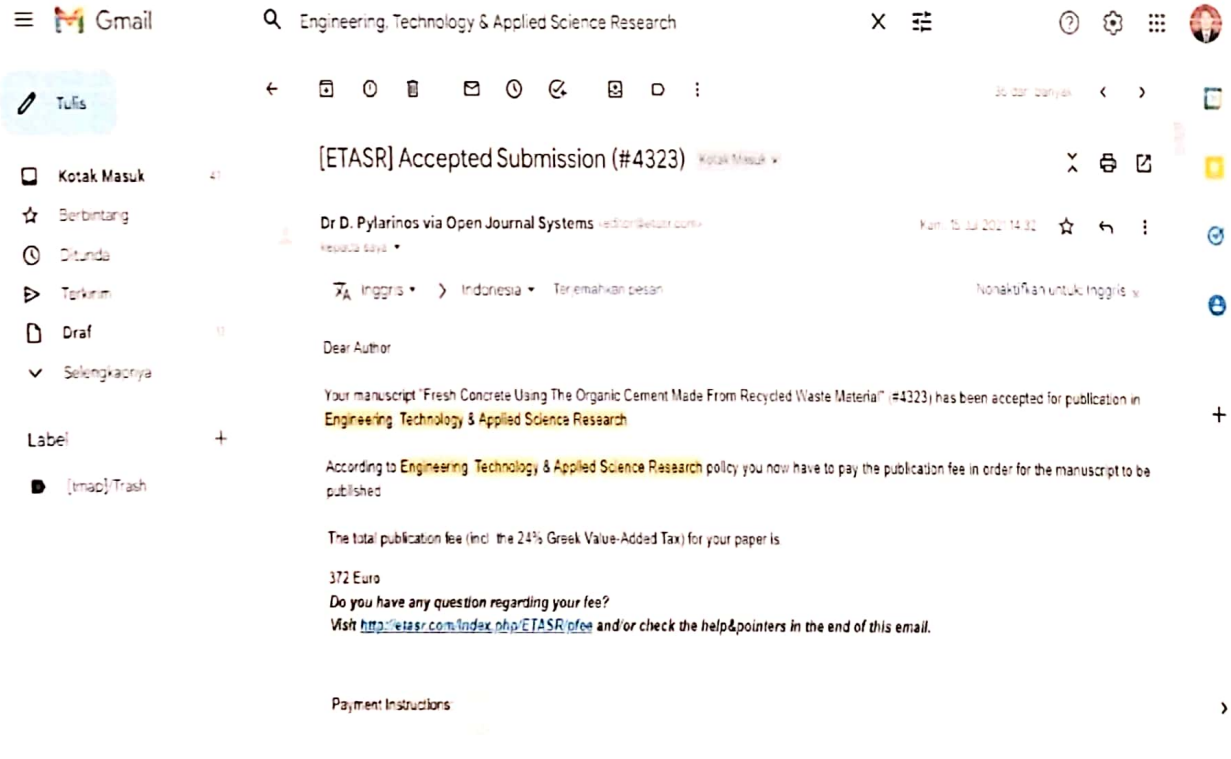

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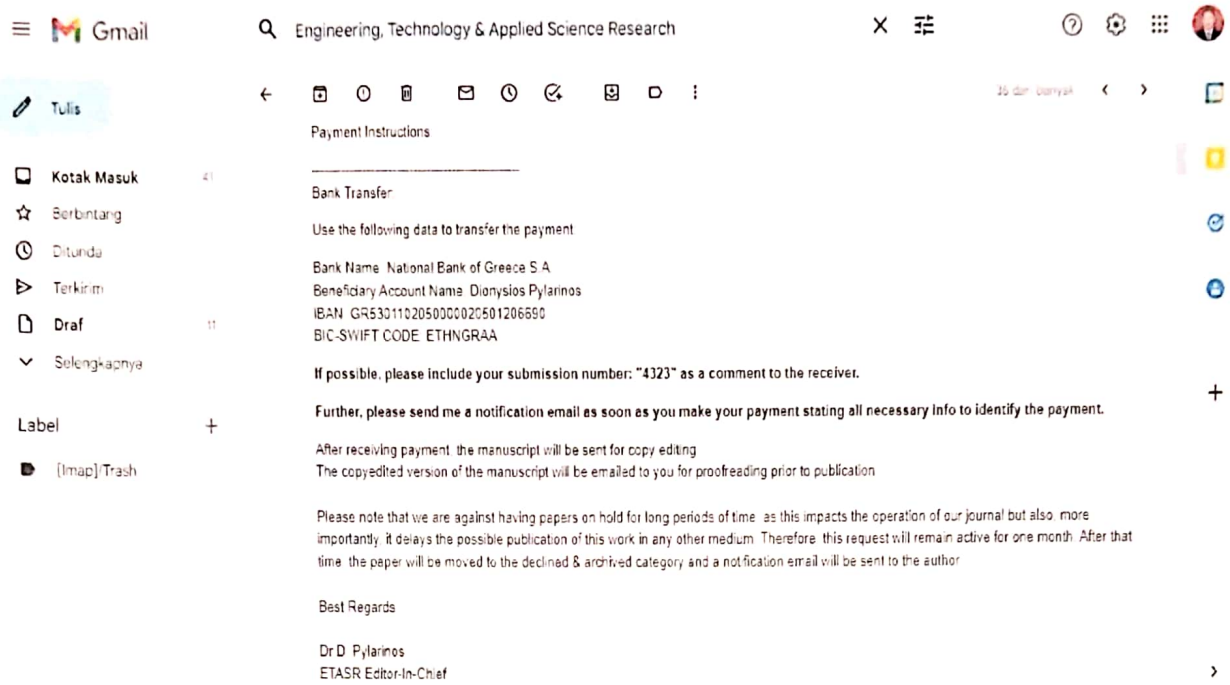

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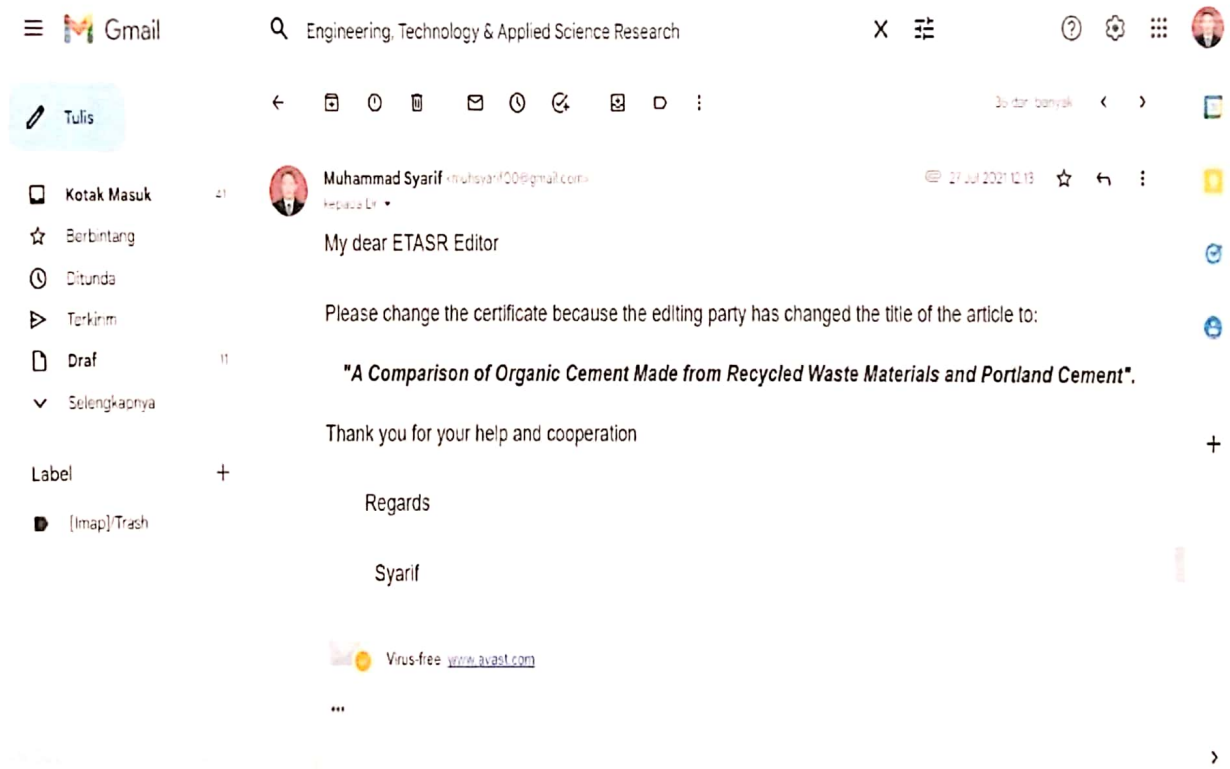

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Muhammad Syarif <muhsyarif00@gmail.com> 27 Jul 2021 12.13

My dear ETASR Editor

Please change the certificate because the editing party has changed the title of the article to:

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Thank you for your help and cooperation

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Syarif

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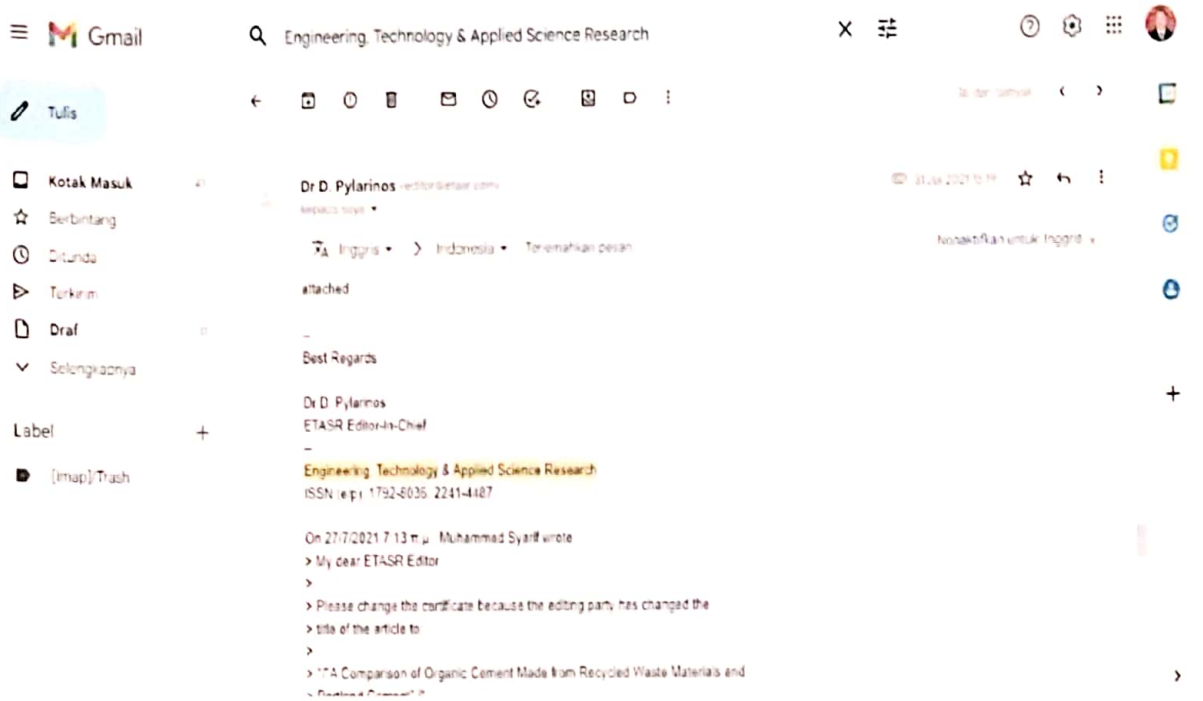

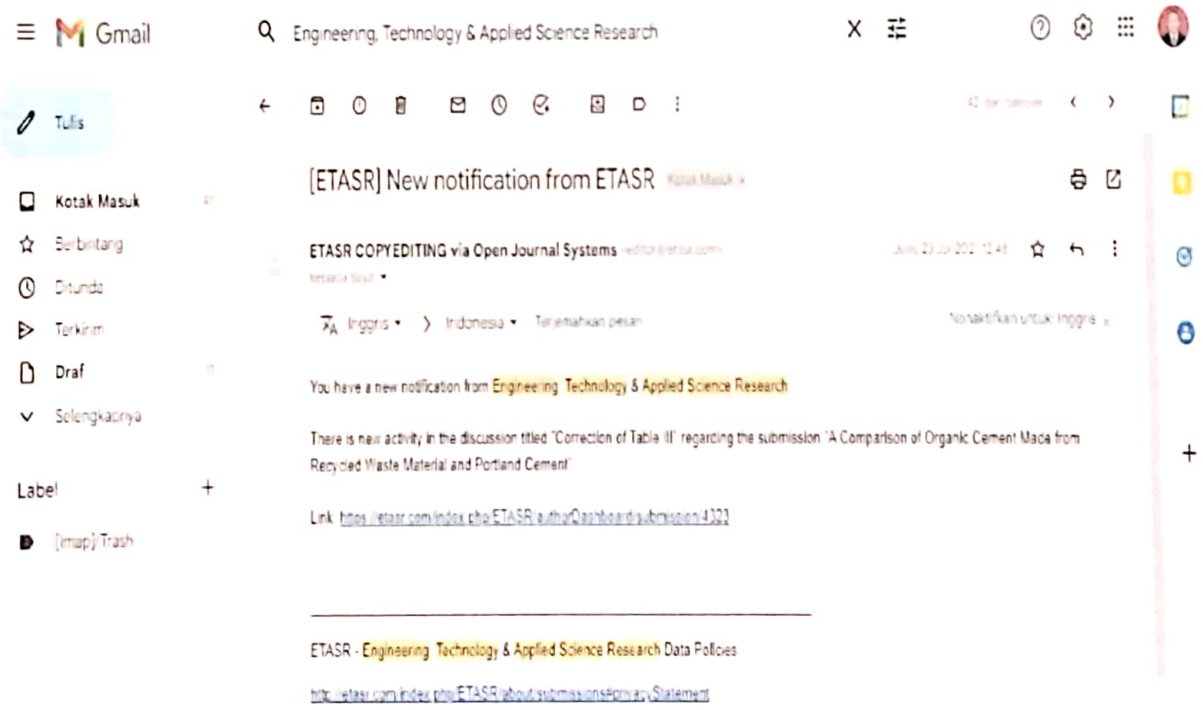

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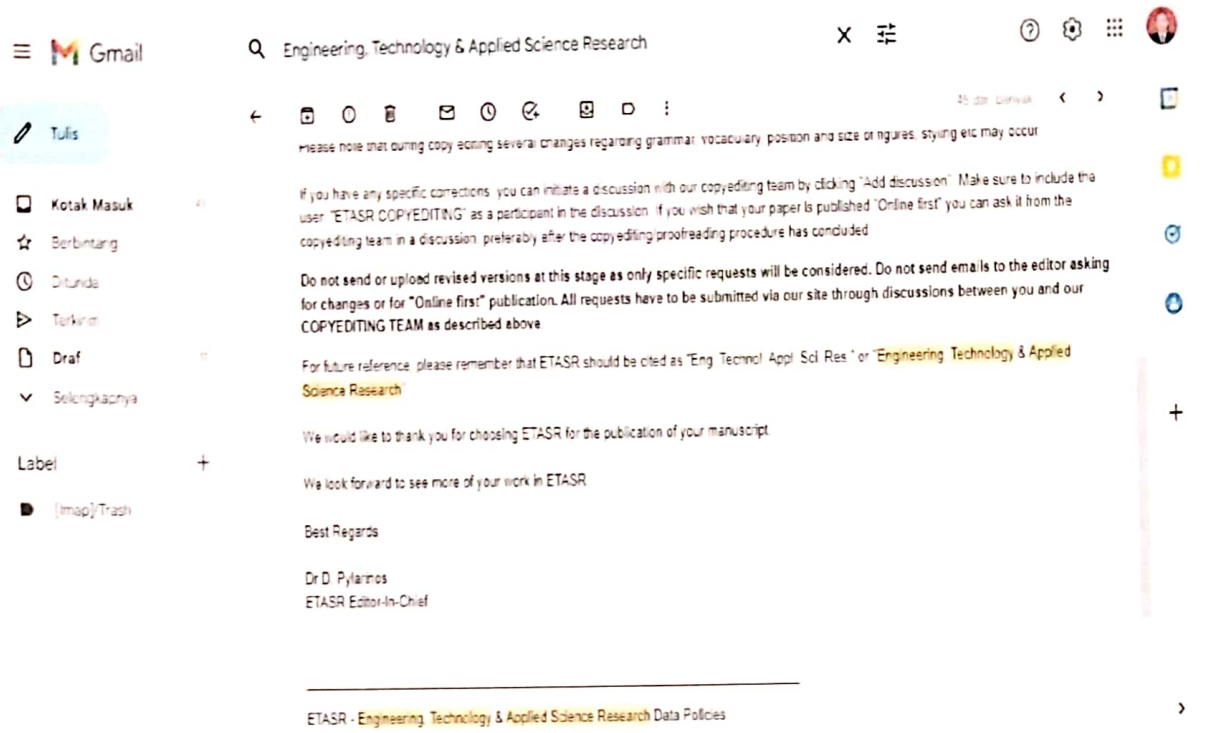

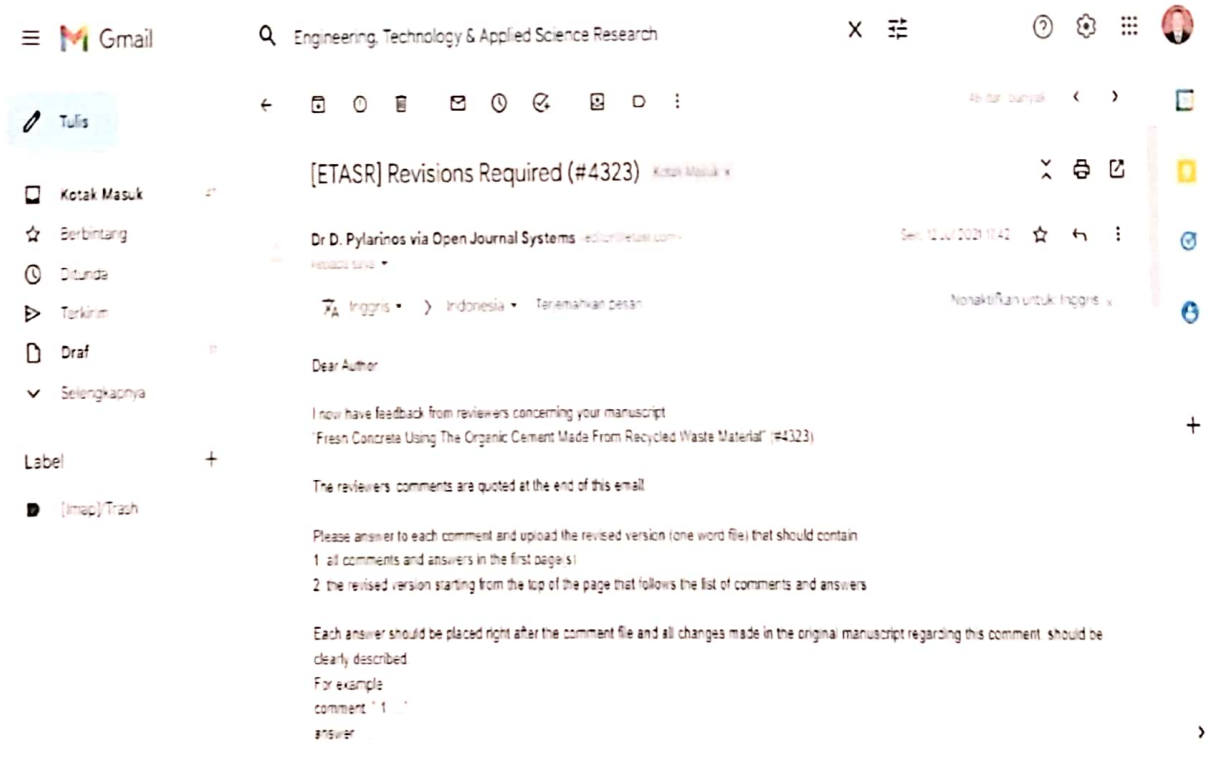

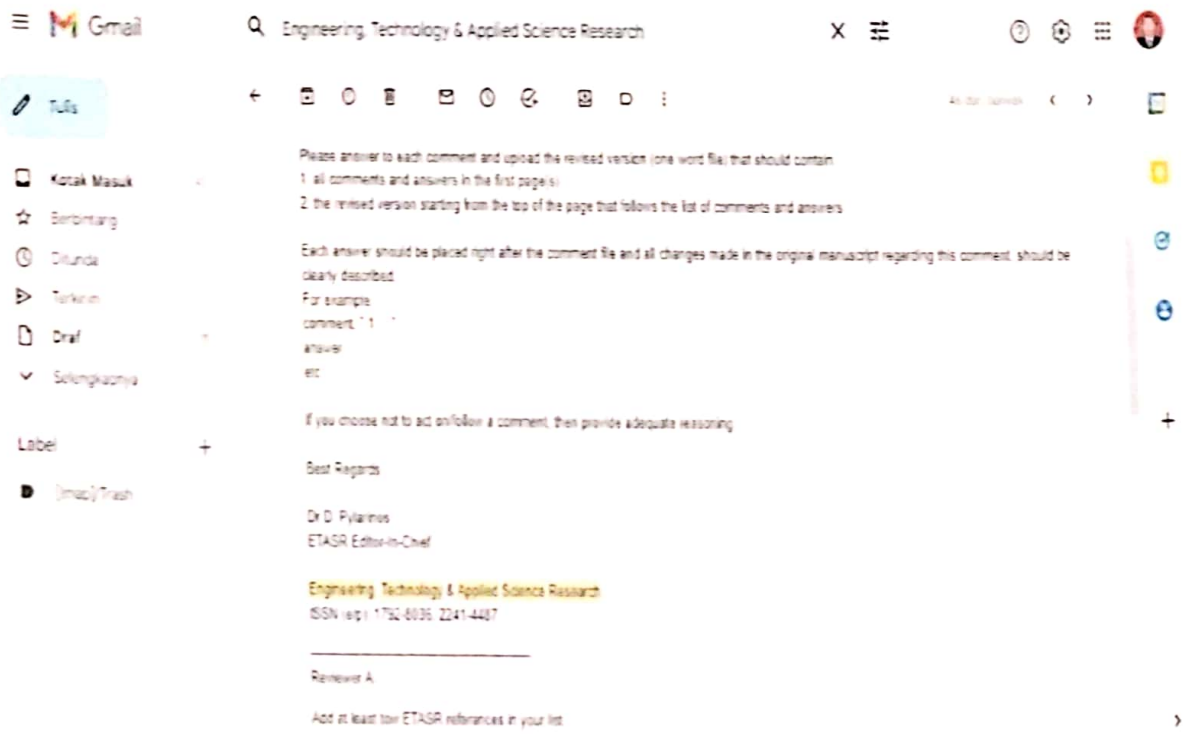

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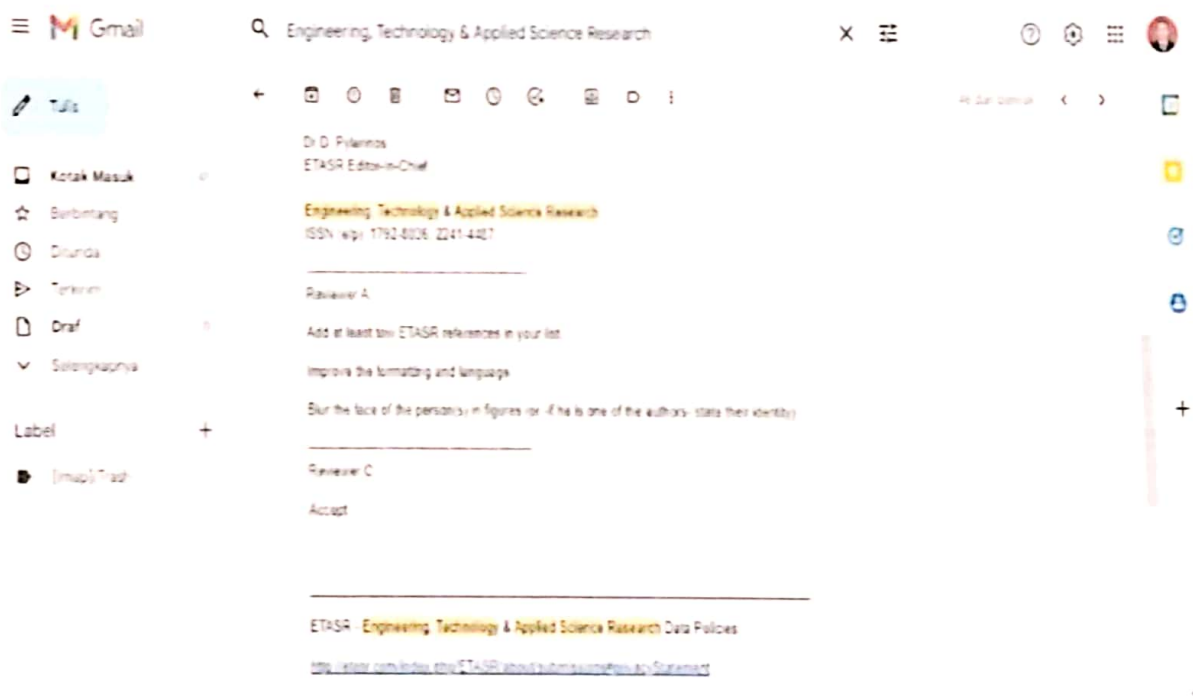

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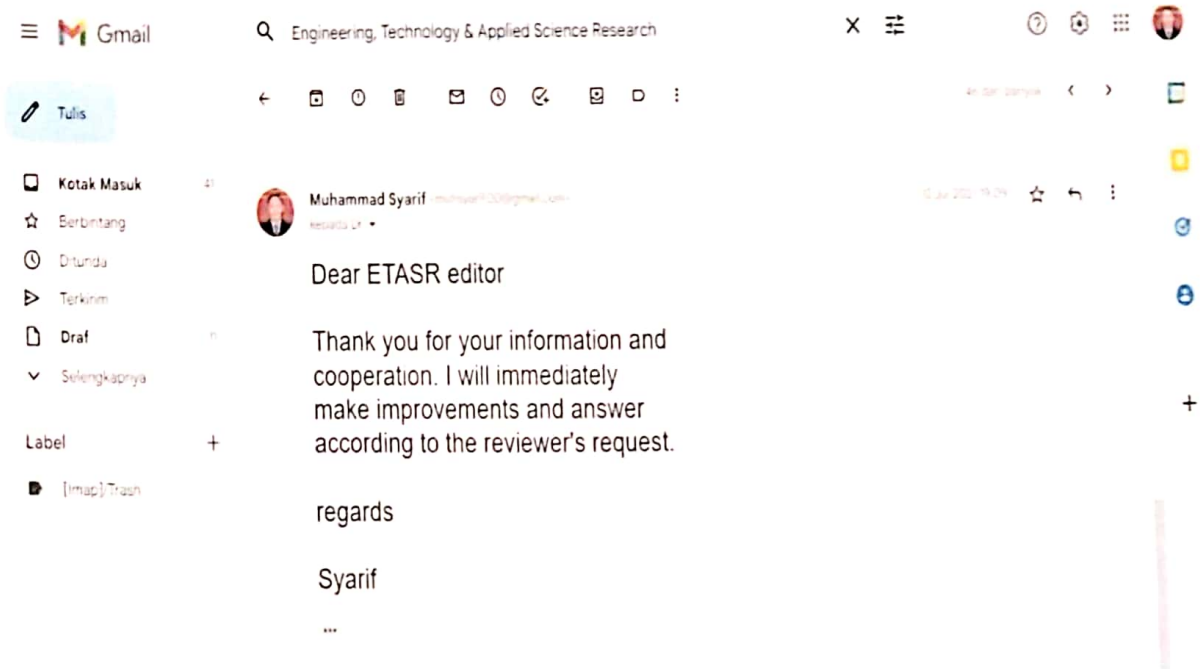

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The greater the percentage of fly ash hydration. then the initial binding time and the end are slower. C3S, C2S, C3A and C4AF compounds will react with water, starting with C3A compounds.

Replacement of 5% cement with fly ash can be used comfortably in new concrete with 50% recycled aggregate from crushing waste. However, concrete can initially be used in low load areas because it has about 11% less strength than conventional concrete [14].

Quote from ETASR inserted at 14

The development of the use of arletrantive sources for the manufacture of cement as well as those developed by Japan which have produced eco-cement made from municipal waste ash through incinerated as a substitute for some of the main raw materials containing 50% of cement raw materials such as mud waste [15].

V. REFERENCES

[14] Chandio, S. A., Memon, B. A., Oad, M., Chandio, F. A., & Memon, M. U. (2020). Effect of Fly Ash on the Compressive Strength of Green Concrete. *Engineering, Technology & Applied Science Research*, *10*(3), 5728–5731. https://doi.org/10.48084/etasr.3499

Reference ETASR at point 14

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Answer :

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Question :

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Answer :

Additional sentence

value of fresh concrete by using portland cement. In Figure 1, it is show the researcher is doing the measuring percentage process the air content value of fresh concrete in both organic cement concrete and portland cement concrete samples.

Figure 1. It is looks the researcher is doing the Measuring process of air content

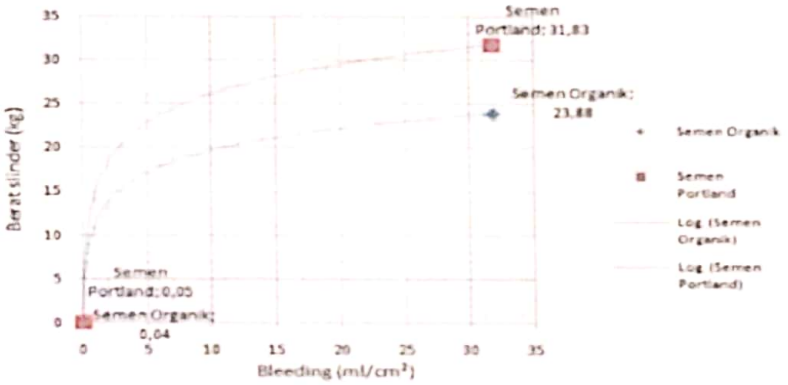
Rersearcher Identity

Note :
The researcher in the photo is Muhammad Syarif

Additional sentence

- Figure 2A it is shows the researcher is doing the process of taking and measuring water bleeding. Figure 2B it is shows a graph of the amount of water bleeding to the cylinder concrete weight between an organic cement cylinder concrete with a portland cement cylinder concrete.

(A)



(B)

Figure 2. It is looks the researcher is doing the Bleeding measurement process (A), The amount of water bleeding graph (B)

Rersearcher Identity

Note :
The researcher in the photo is Muhammad Syarif

Additional sentence

- and figure 4 it is shows the researcher is doing the process of the fineness test of organic and portland cements.

Figure 4. It is looks the researcher is doing the Fineness test process

Rersearcher Identity

- Figure 5 it is shows the researcher is doing the density test process of organic and portland cements.

Additional sentence

Figure 5. It is looks the researcher is doing the density test of organic cement

Rersearcher Identity

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Fresh Concrete Using The Organic Cement Made From Recycled Waste Material

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2st M.Wihardi Tjaronge
Professor, Structure and Material, Dep of Civil Engineering, of Hasanuddin University Of Indonesia

Abstract— Organic cement is the latest alternative cement beside the portland cement as a step to save the environment by recycling organic waste and substituting of mediteran soil. The waste problem is a problem faced throughout the world. This research aims to save the environment with on the utilization of recycling waste materials that do not contribute much in people's lives over the years.. The result of physical characteristic test of organic cement includes weight test of fresh organic concrete unit is 2081 kg/m³ with dry weight of concrete is 2032 kg/m³ which is smaller than fresh weight of concrete using portland cement that is 2525 kg/m³ and its dry weight is 2405 kg/m³. The fineness of alternative cement grains that passed in the 200 mesh sieve is 56%, it is more than portland cement which is 32%. The solid weight of alternative cement is 1200 kg/m³, than the solid weight of portland cement which is 1250 kg/m³.

Key Words: Bleeding; Finenes; mediteran soil ; organic cement ; organic waste ;

I. INTRODUCTION

This study aims as the development of previous experimental research that researchers have done entitled Chacarteristic Of Compressive and Tensile Strength Using The Organic Cement Compare With Portland Cement [1]. An organic cement is the latest alternative cement aside the portland cement which is made through organic waste recycling system and by substitution with mediteran soil [2]. The necessity of building materials need to be addressed by conducting research through the utilization of recycling waste to obtain building materials that can be an alternative material [3].

Currently, the waste problem is a problem faced throughout the world. Gradually, the high volume of waste has a negative impact on the environment. Handling of waste management is necessary because of the huge negative impact that can be generated. The waste problem doesn't seems as a simple matter, as long as there is human life then the problem will always arise. Urban waste management in Indonesia is a real problem because of the population growth has an impact on the increasing of the amount of waste and the occurrence of aesthetic degradation problems around landfills that have potential to cause social conflict with surrounding communities. [4]. Waste is goods or objects that have been depleted the value of the benefits and create a negative impression that makes the waste viewed as objects that must be removed from the home page in any way [5].

The high growth of waste volume coincides with high population growth rate. Therefore, the current waste problem can be assumed to be a world problem. In addition, with good handling and good waste management, environmental savings have been made.Handling of organic waste through the combustion process with the furnace at 700° C to ashes will contain elements of 69.7% CaCo3, 12.1% KCl; 3% SiO2, 8.1% Fe and 3% Al2, while shellfish ash contains 100% CaCo3 [6].

Along with the economic growth, per capita garbage production will continue to increase so it can be predicted in 2030 will reach 1,2 kg / capita / day for urban areas and 0,55 kg / person / day for rural areas. In Indonesia, organic waste is a major component of waste. The proportion of organic waste is between 34-70% which is 20-30% higher than most countries in Europe [7].

Mediteran soil is a soil formed from weathering of sedimentary rock and limestone. This type of soil contains a considerable amount of carbonate and other compounds of iron, water, aluminum, and some other organic materials [8].

The cement containing element fly ash as a substitute for Portland cement is known as composite cement, cement mix, or alternative cement. Additional mineral components are called reactive supplemental minerals and contribute to the hydration process. Other elements additions include natural pozzolans and microsilica / silica fume [9].

The highest tensile strength in 14-day-old concrete with the addition of 5% bagasse ash would have a tensile strength of 6,221 MPa or an increase of 2.45% of the concrete without

Corresponding author: Muhammad Syarif

using the addition of bagasse ash [10]. The increase in cement growth is still influenced by the high level of private sector development and the high demand for housing for the community [11].

A cement that contains mineral elements as a substitute for portland cement is known as composite cement, mixed cement or alternative cement. The added mineral component is called an additional mineral that is reactive and contributes to the hydration process. The added mineral component is called an additional mineral that is reactive and contributes to the process hydration process. The use of saturated fly ash is one way to reduce high exposure in the process of hydration to the density of cement in concrete [12]. Coal waste in the form of fly ash generated from burning waste disposal at power plants is generally still not utilized in most countries [13].

The greater the percentage of fly ash hydration. then the initial binding time and the end are slower. C3S, C2S, C3A and C4AF compounds will react with water, starting with C3A compounds.

Replacement of 5% cement with fly ash can be used comfortably in new concrete with 50% recycled aggregate from crushing waste. However, concrete can initially be used in low load areas because it has about 11% less strength than conventional concrete [14].

The development of the use of arletrantive sources for the manufacture of cement as well as those developed by Japan which have produced eco-cement made from municipal waste ash through incinerated as a substitute for some of the main raw materials containing 50% of cement raw materials such as mud waste [15].

To create an Eco-Semen CSA Clinker then the appropriate starting raw material needs to be burned at a maximum temperature of 1200-1300 ° C. Reuse of waste materials in the form of phosphogypsum will reduce the temperature and time of the combustion process. Large-scale eco-cement making can be done in conventional rotary kilns used for Portland Cement and producing chemical cement mineralization C = CaO, A = Al2O3, S = SiO2, s = SO3, F = Fe2O3, M = MgO. Ye'elimite 4CaO, 3Al2O3, SO3 i.e. C4A3s [16]. The largest flexural strength in 14 days old concrete with the 5% addition of bagasse ash, concrete will have a flexural strength of 6,221 MPa or increased 2.45% strength of concrete without using additional bagasse ash [17].

II. RESEARCH METHODOLOGY

The characteristic of testing is performed on the organic cement where the physical properties testing method is conducted in the laboratory of structure and the materials include bleeding test, air content test, fineness test, normal consistency test, and unit weight test. In this case, the reference to the test method is the American Society for Testing and Materials (ASTM) which includes: ASTM C 188-95 for granular fineness/density tests [18], ASTM C 232-99 for Fresh Concrete Bleeding Test [19] and ASTM C 231-03 for air content of freshly mixed concrete [20]. The reference is a normative reference that is considered very relevant in the process of testing the physical properties of cement

III. RESULTS AND DISCUSSION

A. Air Content

From the measurement, the obtained result of air content in accordance with table 1 which in this research, the researchers calculated the air content value of fresh concrete by using an organic cement test sample compared to the air concrete value of fresh concrete by using portland cement. In Figure 1, it is show the researcher is doing the measuring percentage of process the air content value of fresh concrete in both organic cement concrete and portland cement concrete samples.

Figure 1. It shows the researcher is doing the Measuring process of air content

TABLE 1. AIR CONTENT OF ORGANIC AND PORTLAND CEMENT CONCRETES

	Organic cement concrete	Portland cement concrete
Test concrete volume	0,0016 m³	0,0016 m³
Correction factor reading	1 %	1 %
Reading result	3,2 %	2,9 %
Air content of reading result	2,2 %	1,9 %
Air content for 1 m³ (prediction)	13,75 %	11,88%

B. Bleeding

The amount of water bleeding as shown in table 2, which for the organic cement concrete with the cylinder concrete weight of 3,33 kg has a water-bleeding value of 0.04 ml/cm² so that the prediction of water-bleeding for 1 m³ of organic cement concrete is 23,88 ml/cm³. Meanwhile, for concrete that use portland cement with a cylindrical concrete weight of 3,36 kg has a water-bleeding value of 0,05 ml/cm² and a prediction for 1 m³ of portland cement concrete is 31,83 ml / cm³. Testing of water-bleeding volume of cylinder concrete is calculated by reference according to ASTM C 232-99.

$$\text{Bleeding} = V / A \ldots\ldots (\text{ml/cm}^2) \quad (1)$$

With :

V= water-bleeding volume of test specimen (ml).

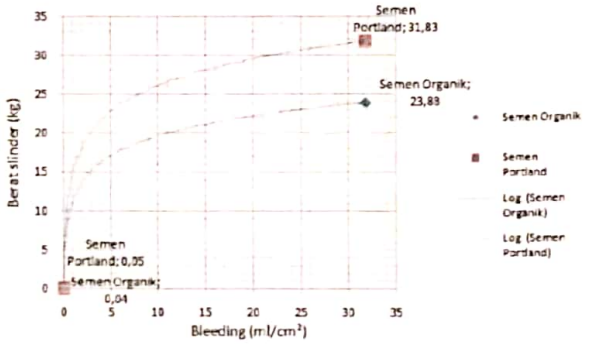
A= surface area of test specimen (cm²)

TABLE 2. BLEEDING TEST ORGANIC AND PORTLAND CEMENT CONCRETE

	Organic cement	Portland cement
Test Specimen Weight	3,33 kg	3,36 kg
Cyclinder Volume	0,0016 m³	0,0016 m³
Test Specimen Area	78,53 cm²	78,53 cm²
Test Specimen Bleeding (V)	3 ml	4 ml`
Bleeding to Test Specimen Area (A) Prediction of bleeding in 1m³ concrete	3/78,53= 0,04 ml/cm² 23,88 ml/cm³	4/78,53= 0,05 ml/cm² 31,83 ml/cm³

Figure 2A it shows the researcher is doing the process of taking and measuring water bleeding. Figure 2B it shows a graph of the amount of water bleeding to the cylinder concrete weight between an organic cement cylinder concrete with a portland cement cylinder concrete.

(A)



(B)

Figure 2. It shows the researcher is doing the Bleeding measurement process (A), The amount of water bleeding graph (B)

C. Fineness and Density

The more fine the cement, the surface of the grains will be wider, so that the compound with water will be faster and requires large amounts of water as well. The value of material fineness for organic cement which passes on 200 mesh sieve is 56% with solid weight of 1200 kg/m³ while for portland cement, it is 52% with solid weight of 1250 kg/m³. Fineness and density tests in this research refer to the ASTM C 188-95 formulation. Figure 3 it shows the fineness of the organic cement and portland cement concentrates and figure 4 it shows the researcher is doing the process of the fineness test of organic and portland cements.

A B

Figure 3. Organic cement with density of 3,05 gr/ml (A) Portland cement with density of 3,15 gr/ml (B)

- Calculation Formula of Fineness Percentage

$$= \frac{D}{B} \times 100\ \% = \frac{C - A}{B} \times 100\ \% \quad (2)$$

With :

D = Weight restrained on each sieve
B = semen sample weight

The density test result of organic cement is 3.05 gr/ml while for the portland cement is 3.15 gr/ml. This density greatly affects the proportion of the cement use in the mixture

Figure 4. It shows the researcher is doing the fineness test process

Figure 5 it shows the researcher is doing the density test process of organic and portland cements.

- Density Calculation Formula used in this research is :

$$\text{Density} = \frac{\text{weight cement}}{(V_2 - V_1)} \times d \quad (3)$$

With :

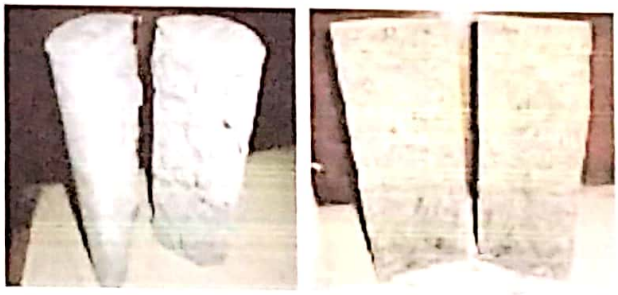
V1= First reading of bottle scale
V2= Second reading of bottle scale
d = contents weight of distilled water = 1 gr/cm^3

Figure 5. It shows the researcher is doing the density test of organic cement

D. Unit weight

The unit weight of fresh concrete using organic cement is 2081 kg/m³ with its dry weight is 2032 kg/m³, while the unit weight of fresh concrete for portland cement is 2525 kg / m³ and its dry concrete is 2405 kg/m³. The unit weight test of dry concrete between portland and organic cements as shown in Table 3 below. The weight measurement of cylinder concrete using organic cement and the weight of cylinder concrete using portland cement it is shown in figure 6A, whereas in figure 6B, it is a cylinder concrete condition that has been tensile-tested at 28 days old concrete.

(A)



(B)

Figure 6. - Weight and temperature measurement of organic cement concrete (A).
- Weight and temperature measurement of portland cement concrete (B)

TABLE 3. UNIT WEIGHT OF FRESH CONCRETE USING ORGANIC CEMENT AND PORTLAND CEMENT

Cylinder mold weight	6,20 kg	6,20 kg
Test specimen weight	9,53-6,20 = 3,33 kg	10,24-6,20 = 4,04 kg
Cylinder Volume	0,0016 cm^3	0,0016 cm^3
Fresh concrete weight	3,33/0,0016 =	4,04/0,0016 =
Dry concrete weight (28 days)	2081 kg/m^3 3,25/0,0016 = 2032 kg/m^3	2525 kg/m^3 3.85/0,0016 = 2405 kg/m^3

IV. CONCLUSIONS

From the test of physical properties of organic cement in the form of granular fineness/density, unit weight of dry and fresh concretes and bleeding by comparing with the physical properties of portland cement. It can be assumed that organic cement has been found to indicate similarities in physical properties with portland cement, where organic cement has also been able to bind and contain amorphous pozzolanic. To achieve improved binding and better resilience, it is deemed necessary to undertake further research as a process of seeking the feasibility of organic cement into an alternative cement other than portland cement.

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A Comparison of Organic Cement Made from Recycled Waste Material and Portland Cement

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Abstract—Organic cement is an environmentally friendly alternative to Portland cement which is acquired by recycled organic waste and Mediterranean soil. Waste management is a global problem. The physical characteristic test results of the organic cement show that the weight test of fresh organic concrete is 2081kg/m³ and the dry weight of concrete is 2032kg/m³ which are smaller than Portland cement concrete's which are 2525kg/m³ and 2405 kg/m³ respectively. The fineness of alternative cement grains that passed the 200 mesh sieve is 56%, which is more than Portland cement's which is 52%. The solid weight of alternative cement is 1200kg/m³ whereas the solid weight of Portland cement is 1250kg/m³.

Keywords-bleeding; finenes; Mediterranean soil; organic cement; organic waste

I. INTRODUCTION

This study aims to develop previous experimental research which can be found in [1]. Organic cement is the latest alternative to Portland cement and is made through organic waste recycling and Mediterranean soil substitution of Portland cement [2]. The necessity of building materials needs to be addressed by researching the utilization of recycling waste to obtain alternative building materials [3]. Gradually, high waste volume has a negative impact on the environment, so handling of waste is necessary. Urban waste management in Indonesia is a real problem as population growth has an impact on the amount of produced waste and the occurrence of degradation problems that have the potential to cause social conflict to the communities [4, 5]. The high growth of waste volume coincides with high population growth rate. Therefore, the waste management problem can be considered as a global problem.

In [6], it was shown that handling of organic waste through the combustion process with the furnace at 700°C will provide materials such as: 69.7% $CaCo_3$, 12.1% KCl, 3% SiO_2, 8.1% Fe and 3% Al_2, while shellfish ash contains 100% $CaCo_3$ [6]. Along with economic growth, per capita garbage production will continue to increase. It is predicted to reach 1.2kg/person/day for urban areas and 0.55kg/person/day for rural areas by 2030. In Indonesia, organic waste is a major component of waste. The proportion of organic waste ranges between 34 and 70% which is 20-30% higher than most countries in Europe [7].

Mediterranean soil is a soil formed from weathering of sedimentary rock and limestone. This type of soil contains a considerable amount of carbonate and compounds of iron, water, aluminum, along with some organic materials [8]. Additional mineral components are called reactive supplemental minerals and contribute to the hydration process. Other additions include natural pozzolans and microsilica/silica fume [9]. The highest tensile strength in 14-day-old concrete with the addition of 5% bagasse ash is 6.221MPa representing an increase of 2.45% [10]. The increase in cement growth is still influenced by the high level of private sector development and the high demand for housing [11]. A cement that contains mineral elements as a substitute for Portland cement is known as composite cement, mixed cement or alternative cement. The additional mineral is reactive and contributes to the hydration process. The use of saturated fly ash is one way to reduce high exposure in the process of hydration to the density of cement in concrete [12, 13]. The use of alternative sources for the manufacture of cement developed in Japan produced eco-cement made from municipal waste ash through incineration as a substitute for some of the main raw materials containing 50% of cement raw materials such as mud waste [14]. To create an Eco-Semen CSA Clinker, the appropriate starting raw material needs to be burned at a maximum temperature of 1200-1300°C. Reuse of waste materials in the form of phosphogypsum will reduce the temperature and duration of the combustion process. Large-scale eco-cement making can be done in conventional rotary kilns used for Portland cement and producing chemical cement mineralization [15].

II. RESEARCH METHODOLOGY

Characteristic testing was performed on the organic cement. The tests included bleeding test, air content test, fineness test, normal consistency test, and unit weight test. The references to the test method come from the American Society for Testing and Materials (ASTM) which include: ASTM C 188-95 for granular fineness/density tests [16], ASTM C 232-99 for fresh concrete bleeding test [17], and ASTM C 231-03 for air content of freshly mixed concrete [18]. They are normative references that are considered very relevant in the process of testing the physical properties of cement.

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III. RESULTS AND DISCUSSION

A. Air Content

The obtained results of air content test can be seen in Table I. In this study, the air content value of fresh concrete was calculated by using an organic cement test sample and the results were compared with the ones of fresh concrete of Portland cement. Figure 1 shows the measuring percentage process of the air content value of fresh concrete in both organic cement concrete and Portland cement concrete samples.

Fig. 1. Measuring process of air content.

TABLE I. AIR CONTENT RESULTS

	Organic cement concrete	Portland cement concrete
Test concrete volume (m^3)	0.0016	0.0016
Correction factor reading	1%	1%
Reading result	3.2%	2.9%
Air content of reading result	2.2%	1.9%
Air content for 1 m^3 (prediction)	13.75%	11.88%

B. Bleeding

The amount of water bleeding is shown in Table II. A organic cement concrete cylinder with a weight of 3.33kg has a water-bleeding value of 0.04ml/cm², so the prediction of water-bleeding for 1m^3 of organic cement concrete is 23.88ml/cm^3. Meanwhile, for concrete that utilizes Portland cement the weight of the same cylinder was 3.36kg with a water-bleeding value of 0.05ml/cm² and the prediction for 1m^3 was 31.83ml/cm^3. Testing of water-bleeding volume of cylinder concrete is calculated by [17]:

$$\text{Bleeding} = V / A \ (\text{ml/cm}^2) \quad (1)$$

where V is the water-bleeding volume of the test specimen (ml) and A is the surface area of the test specimen (cm²).

Figure 2(a) shows the process of taking and measuring water bleeding. Figure 2(b) shows a graph of the amount of water bleeding to the cylinder concrete weight between an organic cement cylinder concrete with a Portland cement cylinder concrete.

TABLE II. BLEEDING TEST RESULTS

	Organic cement	Portland cement
Test specimen weight (kg)	3.33	3.36
Cylinder volume (m^3)	0.0016	0.0016
Test specimen area (cm^2)	78.53	78.53
Test specimen bleeding V (ml)	3	4
V / A (ml/cm^2)	0.04	0.05
Prediction of bleeding in 1m^3 concrete (ml/cm^3)	23.88	31.83

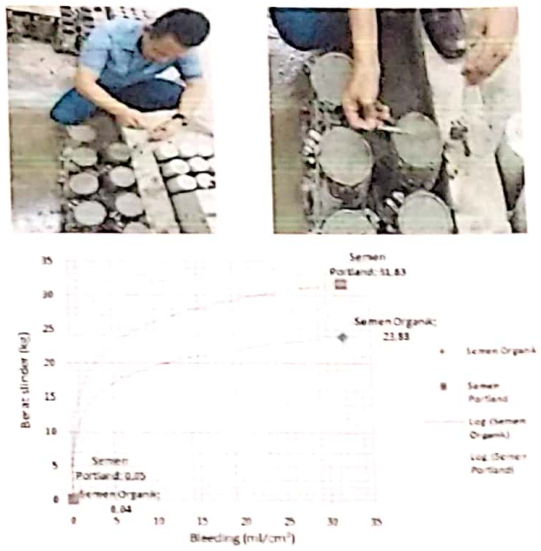

Fig. 2. (a) Bleeding measurement process. (b) amount of water bleeding graph.

C. Fineness and Density

The more fine the cement, the wider the surface of the grains, and the compacting with water will be faster and will require larger amount of water. The value of material fineness for organic cement which passes the 200 mesh sieve is 56% with solid weight of 1200kg/m^3, while for Portland cement, it is 52% with solid weight of 1250kg/m^3. Fineness and density tests in this research refer to the formulation in [16]. Figure 3 shows the fineness of the organic cement and Portland cement concretes whereas Figure 4 shows the process of the fineness test. The calculation formula of fineness percentage is:

$$\frac{D}{B} \times 100\,\% = \frac{C - A}{B} \times 100\,\% \quad (2)$$

where D is the weight restrained on each sieve, B is the sample weight. The density test result of organic cement is 3.05gr/ml while for Portland cement is 3.15gr/ml. This density greatly affects the proportion of the cement use in the mixture. Figure 5 shows the density test process of organic and Portland cements.

(a) (b)

Fig. 3. (a) Organic cement with density of 3.05gr/ml, (b) Portland cement with density of 3.15 gr/ml

Fig. 4. Fineness test process.

The density calculation formula used in this research is :

$$\text{Density} = \frac{\text{cement weight}}{(V_2 - V_1)} \times d \quad (3)$$

where V_1 is the first reading of bottle scale, V_2 the second reading, and d denoted the content weight of distilled water which is 1gr/cm^3.

Fig. 5. Density test of organic cement.

D. Unit Weight

The unit weight of fresh concrete using organic cement is 2081kg/m^3 with its dry weight being 2032kg/m^3, while, for Portland cement, the unit weight of fresh concrete is 2525kg/m^3 with 2405kg m^3 dry weight. The unit weight test results are shown in Table III. The weight of a concrete cylinder using organic cement and of the cylinder using Portland cement are shown in Figure 6(a) whereas in Figure 6B the concrete cylinders' condition at 28 days can be seen.

Fig. 6. Weight and temperature measurement of (a) organic cement concrete, (b) Portland cement concrete.

TABLE III. UNIT WEIGHT TEST RESULTS

Cylinder mold weight (kg)	6.20	6.20
Test specimen weight (kg)	9.53-6.20 = 3.33	10.24-6.20 = 4.04
Cylinder volume (m^3)	0.0016	0.0016
Fresh concrete weight (kg/m^3)	3.33/0.0016 = 2081	4.04/0.0016 = 2525
Dry concrete weight at 28 days (kg/m^3)	3.25/0.0016 = 2031	3.85/0.0016 = 2406

IV. Conclusions

In this paper, the physical properties of organic cement were tested in the form of granular fineness density, unit weight of dry and fresh concrete, and bleeding and the results were compared with the ones regarding Portland cement. Organic cement has been found to indicate similarities in physical properties with Portland cement, whereas organic cement has also been able to bind and contain amorphous pozzolanic materials. To achieve improved binding and better resilience, further research is required as a process of seeking the feasibility of organic cement into an alternative of Portland cement.

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