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# UTILIZATION OF DRAGON FRUIT PEEL EXTRACT FOR THE MANUFACTURE OF DYES IN UREA FERTILIZERS

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## ABSTRACT

Dragon fruit skin contains anthocyanin compounds that can function as natural dyes. Anthocyanins can be used in a number of food products and are safe to use. as dye fertilizer Which made from base organic. Study This was carried out to make urea fertilizer dye products from dragon fruit skin extract with variations in citric acid concentration and maceration time. Dye fertilizer is used as a marker between dye fertilizer urea subsidy And non subsidy. Objective from study This that is to utilize dragon fruit skin extract as a dye in urea fertilizer. The concentration of acid citric Which used is 12%, 14%, 16%, 18% And 20%. As well as variation time

maceration Which used that is 60, 72, 80, 92, And 104 O'clock. Results study show that variation concentration sour citric And time maceration influence quality fertilizer dye produced. The best results obtained were at a citric acid concentration of 20% and a maceration time of 104 hours, with a pH value of 1.54, Viscosity with a value of 1.53, Specific Gravity with a value of 1.052, soluble in water, the resulting color strength is high, but the urea fertilizer dye has not shown stability to temperatures of 30 o C and time storage 10 day. Matter This show concentration Which best has met PT.PIM specifications.

**Keywords:** Sour citric, anthocyanin, dye fertilizer urea, time maceration.

## INTRODUCTION

Colorants have long been used in food and beverages to improve the appearance of food products. In addition to food products, dyes are also used in the textile, cosmetics, household appliances, and other industries. Initially, the dyes used were natural dyes from plants and animals. One of the sources of natural coloring pigments is dragon fruit skin. Dragon fruit skin has the potential as a natural food

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coloring because it produces red color produced by anthocyanin pigments such as cyanidin-3-sophoroside and cyanidin-3-glucoside (Sudarmi, et al 2015).

Dyes in urea fertilizer have several important functions, although the use of dyes in urea fertilizer is not always generally applicable in all markets or regions.

Dyes are used to facilitate the identification of urea fertilizer in distribution and use in the field. By adding color to urea fertilizer, producers and users can more easily identify the type of fertilizer being used, which helps in proper sorting and handling of fertilizer.

Dyes can also serve to prevent misuse of urea fertilizer. For example, dyes can be used to avoid fertilizer counterfeiting or to mark unauthorized fertilizers, especially if there are specific bans or regulations on their use. It can also help prevent the use of fertilizers beyond agricultural purposes, such as in the manufacture of explosives (as urea is an ingredient that can be used in the manufacture of explosives). In addition to Preventing Uneven Distribution, some urea fertilizers are dyed to make it easier for users to ensure a more even distribution when spreading the fertilizer on the farm. The dye helps farmers see where fertilizer has been applied and where it is lacking, thereby improving fertilizer efficiency.

The most important function of the dye in urea fertilizer can also be used as a quality control indicator. It ensures that the product produced conforms to certain specifications and standards. If the fertilizer does not have the this can be a sign that the fertilizer may not meet the desired criteria.

Overall, colorants in urea fertilizers do not affect the effectiveness of the fertilizer itself in providing nutrients to plants, but provide additional benefits in terms of identification, control, and tracking in the use or distribution of fertilizers. urea fertilizer colorants are formulated with red dragon fruit peel extract. This is based on the advantages of red dragon fruit skin (Hylocereus polyrhizus) which has many benefits including for the growth and composition of urea fertilizer is not disturbed. Colorants are additives that play an important role in food and beverages. The addition of coloring materials generally aims to provide a more attractive appearance or in an industry has certain reasons.

Based on previous research conducted by Rachmah A., et al (2018), research was conducted to determine the effect of citric acid concentration and extraction time on the yield value and concentration of anthocyanins obtained. This study varied citric acid concentrations of 8, 10, 12 and 14%. At a concentration of 14% citric acid with a maceration time of 80 hours produced a yield of 54.5% and an

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anthocyanin concentration of 498 mg/l. This also proves that the higher the concentration of citric acid, the higher the yield and anthocyanin concentration.

Based on previous research conducted by Ingrath W, et al (2015), the research was conducted to determine the levels of anthocyanin pigments as natural dyes derived from dragon fruit peels using microwave, as well as to determine the study of heating time and the addition of solvent ratio of distilled water and citric acid.

Based on previous research conducted by Simanjuntak. L. et al (2014), this study aims to determine the type of solvent, solvent ratio and good extraction time and its effect. Anthocyanin dye extraction in this study was carried out by maceration extraction method. The parameters in this study are pH value, absorbance value and anthocyanin pigment yield. The title that will be taken by the researcher is "Utilization of Dragon Fruit Peel Extract for Making Dyes in Urea Fertilizer".

Based on the background that has been discussed previously, the problems that will be discussed by the author in this study are as follows: How the effect of variations in citric acid concentration on product characteristics and How the effect of variations in maceration time on product characteristics.

**Table 1** specification dye fertilizer urea

| SPECIFICATIONS | OWNER REQUIREMENT |
|---|---|
| Color | Red |
| Appearance | Liquid |
| Composition | 3% organic |
| pH | 6 – 8 |
| Viscosity | 16 cps max at 25 deg C |
| Specific Graffiti | 0.9 to 1.2 |
| Solubility | Soluble in water |
| Tinting Strength | Note Fade in water |
| Complete with label | MSDS, Hazard Symbol |
| Packing | Drum of 200 kg |

Source : PPE PT. PIM

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## METHOD

1. Tools And Material

The tools used in this study include a glass measuring cylinder, drop pipette, spatula, beaker glass, litmus pH paper, glass slides, blender, filter paper, maceration receptacle, Ostwald viscometer, and a rotary vacuum evaporator. The materials used in this study include dragon fruit peel, citric acid (technical grade 97%), NH4OH 25%, distilled water (aquadest), white paint, and synthetic red dye Fe2O3.Preparation of Potassium Granule Fertilizer of Oil Palm Empty Bunch Burnt Ash.

### Making Extract Skin Fruit Dragon

1. Wash skin fruit dragon with water clean For remove dirt.
2. Then cut the dragon fruit skin into small pieces to make the extraction process more effective.
3. Furthermore insert piece rind dragon to in a blender.
4. Insert skin Dragon fruit which are already in a blender in maceration container .
5. Add citric acid solvent according to the assignment sheet with the ratio 1:5.
6. Close the container and let it sit according to the sheet. tasks and avoid sun exposure.
7. After the maceration time is complete, filter the solution using filter paper to obtain the dragon fruit skin extract filtrate.
8. Results filtrate the concentrated with use tool Rotary Vacuum Evaporator .

### Testing Dye Experience Fertilizer Urea

### Test pH

- Insert dye to in beaker glass
- Insert pH meters to in receptacle filtrate each- each sample for pH measurement
- Repeat treatment to all sample.

### Viscosity Test

- Install viscometer in a way vertical in rack testing.
- Get ready sample on temperature 25 O C.
- Insert sample to in viscometer until reach volume Which according to the tool instructions.

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- Get ready stopwatch , let fluid flow through capillary from One point certain point to another point.
- Then viscosity counted to use formula :

$\eta = K \cdot \rho \cdot t$

Where :

$\eta$ = viscosity dynamic (cP or mPa.s),

K = constant calibration viscometer ( 0.0048337 mm 2 /s 3 ),

$\rho$ = density of solution ( g/ml)

t = time that required liquid for flow (s)

**Test Specific Gravity**

- Take dye sample and enter into the glass measuring 250 ml
- Enter hydrometer scale 1,000 – 1,200.
- Look And note results Which obtained.

**Solubility Test**

- Pour it out a number of water (around 10-20 ml) to in glass chemistry or tube reaction.
- Add a number of drops dye fertilizer to in water use pipette drops.
- Stir mixture with gentle use mixer.
- Observe whether dye mixed up evenly in water or There is part that settles or separates.
- If dye united And late fully in water without sediment or particles, then the dye is soluble in water.
- If there is sediment or particle which is not mixed, so dye it is not completely soluble in water.

**Test Tinting Strength (ASTM D387)**

- Material Which required is sample dye fertilizer Which will tested And standard dye (Fe 2 O 3 ) with the same or nearly similar color.
- Weigh a number of certain dye standard, Then dissolve in solvent Which appropriate (e.g. water) to produce a standard solution with a certain concentration.

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- Weigh the fertilizer dye samples to be tested in equal amounts, then dissolve them in the same amount of solvent to make a test solution with an equivalent concentration.
- Mixing with Media (If Required):
- In a number of test tinting strength, mixture dye mixed with media (white paint) to see the strength of the color when mixed.
- Take a certain amount of standard solution and test solution, mix it with the medium in the same ratio for both.
- Observation Visual
- Visual Method: Apply the standard and test mixtures side by side on a glass slide or other test medium, then compare the color intensity visually .
- Evaluation Tinting Strength:
- If the color of the test dye sample mixture appears stronger or more concentrated than the standard, it means that its tinting strength is higher.
- Conversely, if the color is weaker or less intense, the tinting strength is lower.

**Test Stability dye fertilizer against temperature storage**

- Take 4 samples best selected from previous test
- Made atmosphere with temperature 30 O C .
- Observed by measuring temperature use thermometer
- Save Sample in condition closed without light during 10 days.
- After 10 day, observe change color that happened.

## RESULTS AND DISCUSSION

### Result

Results Study Which Already done For make dye fertilizer urea from dragon fruit skin and conducting tests produced with variants, can be seen in the following table.

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Table 2 make dye fertilizer urea from dragon fruit skin and conducting tests produced with variants

| Citric Acid (%) | Extraction Time (Hours) | pH | Viscosity (Cps) | Specific Gravity |
|---|---|---|---|---|
| 1 | 2 | 4 | 5 | 6 |
| 12 | 60 | 1.70 | 2.13 | 1,069 |
| | 72 | 1.69 | 1.67 | 1,071 |
| | 80 | 1.69 | 1.71 | 1,063 |
| | 92 | 1.68 | 1.92 | 1,064 |
| | 104 | 1.67 | 1.83 | 1,065 |
| 14 | 60 | 1.64 | 1.89 | 1,066 |
| | 72 | 1.63 | 2.54 | 1,065 |
| | 80 | 1.63 | 1.56 | 1,068 |
| | 92 | 1.62 | 2.23 | 1,066 |
| | 104 | 1.62 | 2.34 | 1,065 |
| 16 | 60 | 1.61 | 2.34 | 1,062 |
| | 72 | 1.61 | 2.01 | 1,072 |
| | 80 | 1.61 | 1.89 | 1,073 |
| | 92 | 1.60 | 2.15 | 1,067 |
| | 104 | 1.60 | 1.58 | 1,058 |
| 18 | 60 | 1.59 | 1.59 | 1,065 |
| | 72 | 1.59 | 1.64 | 1,063 |
| | 80 | 1.58 | 1.67 | 1,068 |
| | 92 | 1.58 | 1.51 | 1,056 |
| | 104 | 1.57 | 1.58 | 1,054 |
| 20 | 60 | 1.56 | 1.88 | 1,072 |
| | 72 | 1.56 | 1.66 | 1,067 |
| | 80 | 1.55 | 1.51 | 1,058 |
| | 92 | 1.55 | 1.50 | 1,056 |
| | 104 | 1.54 | 1.53 | 1,052 |

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## Testing pH

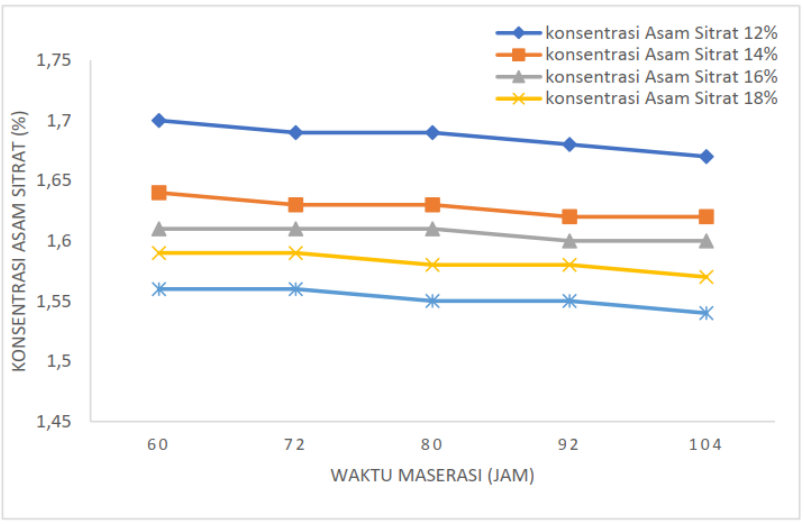


Figure 1 Curve of citric acid concentration and maceration time against pH pH is degrees acidity Which used For state level acidity

or the alkalinity of a solution. According to the Specifications of PT. PIM Pewarna Urea fertilizer must have a pH value of 6-8. In Figure 4.1 can be seen in the variations acid concentration citric 12%; 14%; 16%; 18%; 20% and time variation maceration 60 hours; 72 hours; 80 hours; 92 hours and 24 hours have a pH in the range of 1-2. This proves the effect of citric acid which is increasingly concentrated, the lower the pH value, which indicates that the fertilizer dye product is acidic.

Matter This state pH dye This Still not yet in specification. Matter This occurs because the maceration process uses citric acid which is acidic. So it is necessary to add Ammonia Hydroxide or a weak base slowly to make the pH of the dye neutral and not change color to blue. However, this answers the red color produced from the anthocyanin extract successfully extracted completely because anthocyanin is stable at pH 1-3.

## Viscosity Testing

Viscosity testing is carried out to determine the size of the thickness or resistance dye fertilizer to flow. Can seen on Picture 4.2 dyes Urea fertilizer in this study has met the specifications of PT. Pupuk Iskandar Uda which has a value of 16 cps at a temperature of 25 O C. The average viscosity results obtained for the product This is 1.83 cps. Should The more big concentration sour citric And time

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The longer the maceration, the higher the viscosity produced by this urea fertilizer dye, but what actually happens does not answer that, this is due to the type of solvent used, namely water and citric acid so that the viscosity produced by this fertilizer dye has a low viscosity value, but the dye produced has passed the specifications of PT. PIM urea fertilizer dye.

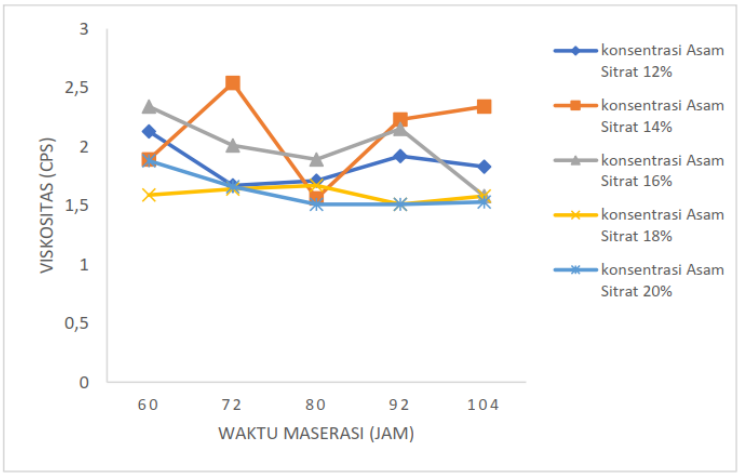


Figure 2 Curve Concentration sour citric And time maceration on Viscosity

**Testing Specific Gravity**

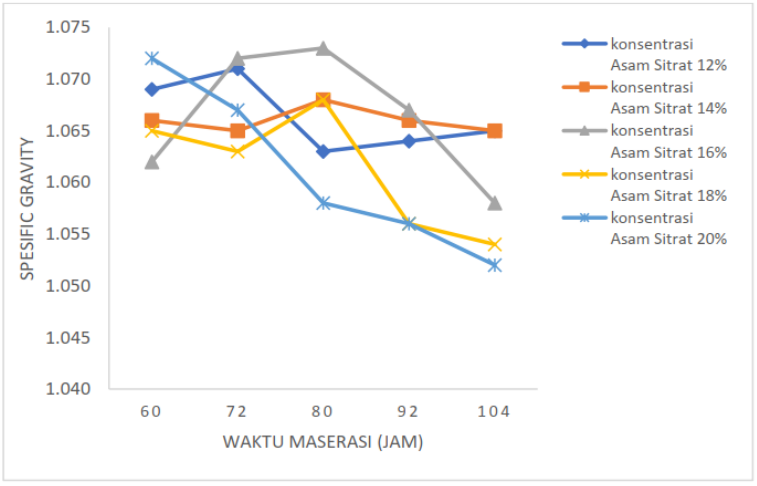


Figure 3 Curve concentration sour citric And time maceration against specific gravity

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Specific Gravity is the ratio between the specific gravity of a substance and the specific gravity of water at a certain temperature. Specific Gravity testing is carried out to determine the specific gravity of the fertilizer dye produced. In Figure 4.3 it can be seen that each product produced from the variation of citric acid concentration and the variation of maceration time carried out has fulfil specification PT. PIM Which own range 0.9 – 1,2. Flat The average Specific Gravity value produced by the fertilizer dye is 1.064. The best product in this test is in the citric acid variation of 16%: 104 hours of maceration time which has mark 1,058, Sour citric 18% : 92 O'clock time maceration Which own mark 1.054, 18% citric acid: 104 hours of maceration time which has a value of 1.054, 20% citric acid: 80 hours of maceration time which has a value of 1.058, 20% citric acid: 92 hours of maceration time Which own mark 1,056 And sour citric 20% : 104 O'clock time maceration which has a value of 1.052.

**Testing Solubility**

Solubility is ability dye For late in water, can seen on table 3

Table 3 Results Test research Solubility

| Sour Citric (%) | Extraction Time (O'clock) | Solubility (visual) |
|---|---|---|
| 1 | 2 | 3 |
| 12 | 60 | Late in water |
| | 72 | Late in water |
| | 80 | Late in water |
| | 92 | Late in water |
| | 104 | Late in water |
| 14 | 60 | Late in water |
| | 72 | Late in water |
| | 80 | Late in water |
| | 92 | Late in water |
| | 104 | Late in water |

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| 1 | 2 | 3 |
|---|---|---|
| 16 | 60 | Late in water |
| | 72 | Late in water |
| | 80 | Late in water |
| | 92 | Late in water |
| | 104 | Late in water |
| 18 | 60 | Late in water |
| | 72 | Late in water |
| | 80 | Late in water |
| | 92 | Late in water |
| | 104 | Late in water |
| 20 | 60 | Late in water |
| | 72 | Late in water |
| | 80 | Late in water |
| | 92 | Late in water |
| | 104 | Late in water |

According to the PIM specifications, fertilizer dyes must be soluble in water. Solubility testing is done by dissolving 50 ml of fertilizer dye in 100 ml water, stirred in a way slowly Then Wait 5 minute see whether dye And water separated or dissolved. In this study, the urea fertilizer dye produced has been proven to be soluble in water and meets the specifications of PT PIM.

## Testing Tinting Strength

Tinting strength is characteristic No faded in water. In accordance with specification PT. This PIM test is carried out to determine the color strength of the fertilizer dye and the dye must not fade, it can be seen in table 4 below

| Sour Citric (%) | Extraction Time (O'clock) | Tinting Strength (visual) |
|---|---|---|
| 1 | 2 | 3 |
| 12 | 60 | Low |
| | 72 | Low |
| | 80 | Low |

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| 1 | 2 | 3 |
|---|---|---|
| | 92 | Low |
| | 104 | Tall |
| | 60 | Low |
| | 72 | Low |
| 14 | 80 | Low |
| | 92 | Low |
| | 104 | Low |
| | 60 | Low |
| | 72 | Low |
| 16 | 80 | Low |
| | 92 | Tall |
| | 104 | Tall |
| | 60 | Low |
| | 72 | Low |
| 18 | 80 | Low |
| | 92 | Tall |
| | 104 | Tall |
| | 60 | Low |
| | 72 | Tall |
| 20 | 80 | Tall |
| | 92 | Tall |
| | 104 | Tall |

In the table it can be seen that many of the products produced do not have high color strength, this is due to the poor maceration extraction factor. Which due to by skin fruit dragon Which Still young so that pigment red the resulting product is less than optimal. Another factor that influences this is because existence addition material chemistry language For make pH dye become neutral so that the color is slightly degraded by the influence of the alkaline chemicals used.

Testing Stability Dye to temperature storage 30 $^{o}$C

Testing stability anthocyanin This done For know variation The best concentration of fertilizer dye products produced at a storage temperature of 30 $^{o}$C .

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Table 5. Results Study stability test dye to temperature storage 30 $^{o}$C

| Sample | Storage Temperatue ( $^{o}$C ) | Time | Changes (visual) |
|---|---|---|---|
| 18%; 92 hours | 30 | 10 Days | The more Fade |
| 18%; 104 hours | | | The more Fade |
| 20%; 92 hours | | | The more Fade |
| 20%; 104 hours | | | The more Fade |

In Table 5 It can be seen that the fertilizer dye products produced all have color changes, however, with variations in citric acid concentration of 20% and maceration time of 104 hours, the color produced is more concentrated than variations in the concentration of other products.

This is because the fertilizer dyes tested use organic base materials, where natural dyes do have shortcomings in color resistance compared to synthetic dyes. Therefore, natural dyes need to be coated with certain materials so that the resulting color is not degraded by factors that influence it.

In this test, it can be concluded that the best product is in the concentration variation. sour citric 20% And variation time maceration 104 O'clock. According to Wulaningrum 2013, the higher the acid concentration, the more dyes are extracted. The stability of anthocyanins contained in dyes is influenced by temperature, oxidants and UV rays.

## CONCLUSION

From results study Which Already done can concluded that :

1. Variation concentration sour citric influential to pH, the more big concentration, the lower the pH.
2. Variations in citric acid concentration affect viscosity, the higher the concentration, the higher the viscosity.
3. Variations in citric acid concentration and maceration time affect the coloring strength, the greater the concentration and maceration time, the higher the coloring strength.

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4. Variations in citric acid concentration and maceration time affect the solubility of the dye, with the dye produced according to specifications.
5. Stability testing dye on storage temperature 30 $^{o}$C during 10 days, the longer it is stored, the more faded the dye will be.
6. Based on the research conducted, variations in citric acid concentration affect the characteristics of the product obtained, and the best conditions were obtained at a citric acid concentration of 20%.
7. Based on study Which done variation time maceration influential on the characteristics of the product obtained, and the best conditions were obtained during maceration. 104 hours.

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