Utilization of Red Onion Skin Waste as Natural Dyes

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Abstract: Red onion skin waste can be used as food coloring. Red onion skin is one source of brownish orange color derived from anthocyanin compounds and is used as natural dyes for traditional foods. The purpose of this study was to determine the most influential variables of reaction time, material size, and ratio weight material to the volume solvent in red onion skin extraction. The research method used is an experimental design method, where this method means a set of differences designed to obtain evidence of a hypothesis data. This research was carried out at a temperature of 80^{o}C and using 80% ethanol solvent. The results showed that the most influential was the ratio of weight material to volume solvent. The optimum results were obtained at a ratio of 1 gr: 14 ml with an extraction time of 2 hours and a size of 60-80 mesh.

1 INTRODUCTION

The addition of food additives, especially food coloring, aims to provide a more attractive color, sometimes the use of food coloring agents does not pay attention to their effects on health. Some parties use harmful dyes to produce attractive and selling food products to get the maximum profit.

Dyes commonly used are natural coloring agents and synthetic coloring agents. Natural coloring agents, made from extracts of certain plant parts. Synthetic dyes, made from chemicals. Compared to natural dyes, synthetic dyes have several advantages, namely more color choices, easy to store and long lasting. Some of the weaknesses of synthetic dyes include carcinogenic and toxic properties (Winarno, 1997).

The use of natural dyes has been widely used by the community, among others, the yellow color of turmeric, the green color of the suji leaf, the purple color of purple sweet potato, the black color of the straw and others. Onion skin is one of the sources of brownish orange color derived from anthocyanin compounds and is used as a coloring agent for traditional foods (Cahyadi, 2009)

Oancea (2013) conducted a study that found the highest total Anthocyanin 99.66 mg/100 g of anthocyanin extract ingredients from the outer skin part of dried onion grown in Romania. The solvents used were ethanol/acetic acid/water (50/8/42), ethanol/acetic acid / water (70/4/26), ethanol/acetic acid/water (80/1/19); 50% ethanol (v/v); ethanol 70% (v/v), and ethanol 80% (v/v). From the results of the study, the best type of solvent is 80% ethanol.

Red onion also have high levels of flavonoids, especially in the form of quercetin. Quercetin is a flavonoid compound that can reduce blood pressure and prevent plaque in arteries that can cause strokes. The content of flavonoids in 1 kg of onion (Allium ascalonicum) is approximately 415-1917 mg. The onion skin has more antioxidants than the onion itself.

Concerns about the safety of the use of synthetic dyes encourage the development of natural dyes as food coloring ingredients. The use of synthetic dyes can be replaced with natural dyes. Red onion skin can be used as a natural food coloring because it has a color pigment, namely anthocyanin compounds. These compounds play a role in the onion skin coloring (Jackman, 1996).

Red onion skin is commonly found as household waste and has been underutilized optimally and it's useless . To be able to utilize the onion skin waste, it can be used as food coloring. So that the onion skin waste can be something more economical and has a selling value.

Hussein and Alhassanen extracted the onion skin as a dye using the reflux process, this is done so that the anthocyanin compounds found in the onion skin are easier to extract. The extraction process is carried out for 40 minutes. So in this study variations will be made with the smallest extraction

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time of 40 minutes and the largest is 120 minutes to determine the effect of the extraction time. In addition, variations in material size and comparison between ingredients and solvents were added to see which conditions were the most optimum in the process of taking dyes on the onion skin.

There are a number of extraction methods, the simplest is cold extraction, in this way the dried material produced by the mill is extracted at room temperature in a row with the solvent with the higher polarity. The advantage of this method is that the extraction method is easy because the extract is not heated so it is less possibility that the natural material will decompose.

The use of solvents with increased polarity of natural materials will separate natural ingredients based on solubility. This makes the isolation process becomes easier (Rodrigues et al., 2003).

2 MATERIALS AND METHOD

2.1 Material

In this study the material used is dry onion skin on the market regardless of its type. Another supporting material used in this study is 80% ethanol as a solvent

2.2 Experimental

2.2.1 Sample Preparation

Red onion skin is cleaned from dirt by rinsing use running water. Dry under the sun and oven at 50°C until dry. After drying and mashed with blending and then sieved with a 40-60 mesh and 80-100 mesh sieve.

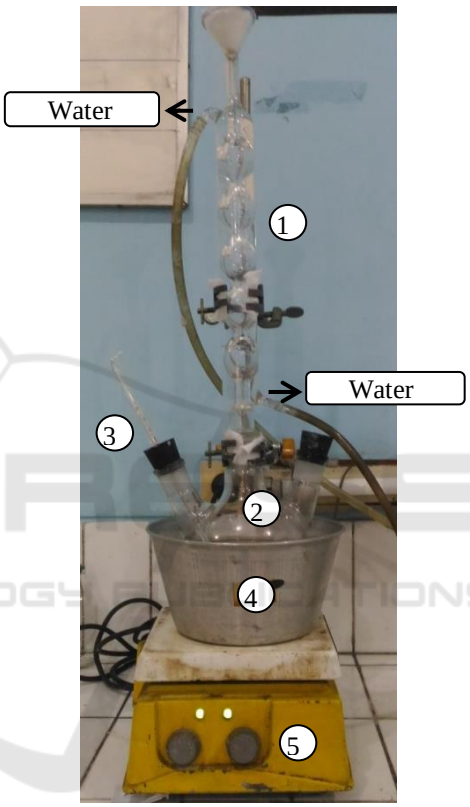
Research methodology used is Experimental design. Experimental design is a set of data designed to obtain concrete data to prove a hypothesis. Experimental design method with two-level factorial design, low level (-) and high level (+) is used for reasons because a little run for each variable is investigated, so it can save time, cost, and material.

In this study using a fixed variable: temperature 80^{o}C and 80% ethanol solvent, while the variable changed: extraction time (t) 40 and 120 minutes, the ratio of ingredients solvent (R) was 1:10 and 1:15, the size of the material (N) was 40-60 and 80-100 mesh.

The tool used is an extraction tool (reflux) consisting of three neck flasks, condensor, hot plates, magnetic stirrers, ovens, thermometers, water bath.

2.2.2 Extraction Process

The onion skin is weighed as needed, put in a three-neck flask. 80% ethanol is put into a three-neck flask, then assemble the appliance and attach a hose that connects the condenser and water tap as shown in Figure 1.



(1) Condensor, (2) three neck flasks, (3) thermometers, (4) water bath, (5) hot plate

Figure 1: Extraction tool.

Extraction is done by varying the extraction time, material:solvent ratio and material size. The extraction results obtained were then concentrated in a waterbath at 50^{o}C. Then weighed and calculated the resulting dyes content.

Anthocyanin testing was carried out by 2 mL red onion skin extract added with 2 mL HCl 2 M. Then it is heated at 100 ° C for 5 minutes, if it appears red then the result is positive.

3 RESULTS AND DISCUSSION

The results of the research that have been carried out are obtained shown in Table 1.

Table 1: Results observations of yield.

t (minutes)	R (rasio)	N (mesh)	Yield (%)
40	1 : 10	40-60	5.52
120	1 : 10	40-60	5.68
40	1 : 15	40-60	6.63
120	1 : 15	40-60	7.38
40	1 : 10	80-100	6.66
120	1 : 10	80-100	6.80
40	1 : 15	80-100	8.92
120	1 : 15	80-100	10.61

The yield results from Table 1 are included in the calculation formula for the effect, to find the most influential variables using chart % P vs Z (Normal Probability Curve) and % P vs I.

Calculation of the main effects:

$I_0 = \frac{1}{8} (Y_1 + Y_2 + Y_3 + Y_4 + Y_5 + Y_6 + Y_7 + Y_8)$

$I_t = \frac{1}{4} (-Y_1 + Y_2 - Y_3 + Y_4 - Y_5 + Y_6 - Y_7 + Y_8)$

$I_R = \frac{1}{4} (-Y_1 - Y_2 + Y_3 + Y_4 - Y_5 - Y_6 + Y_7 + Y_8)$

$I_N = \frac{1}{4} (-Y_1 - Y_2 - Y_3 - Y_4 + Y_5 + Y_6 + Y_7 + Y_8)$

Calculation of interaction effects:

$I_{t.R} = \frac{1}{4} (Y_1 - Y_2 - Y_3 + Y_4 + Y_5 - Y_6 - Y_7 + Y_8)$

$I_{t.N} = \frac{1}{4} (Y_1 - Y_2 + Y_3 - Y_4 - Y_5 + Y_6 - Y_7 + Y_8)$

$I_{R.N} = \frac{1}{4} (Y_1 + Y_2 - Y_3 - Y_4 - Y_5 - Y_6 + Y_7 + Y_8)$

$I_{t.R.N} = \frac{1}{4} (-Y_1 + Y_2 + Y_3 - Y_4 + Y_5 - Y_6 - Y_7 + Y_8)$

The results of the calculation of effects are presented in Table 2.

Table 2: The results of the calculation of the effect value.

No.	Effect	Efffect Identity	$\%P = \frac{i=5}{n} \times 100\%$
1	0,2281	$I_{t.N}$	7,14
2	0,2381	$I_{t.R.N}$	21,43
3	0,5367	$I_{t.R}$	35,71
4	0,6867	I_t	50,00
5	0,8127	$I_{R.N}$	64,28
6	1,9427	I_N	78,57
7	2,2189	I_R	92,86

Based on the chart % P vs Z and % P vs I, the most influential variable is I_R (variable ratio of materials and solvents). This can be seen from chart %P vs I (Figure 2), which is the farthest point from the 'approach line'

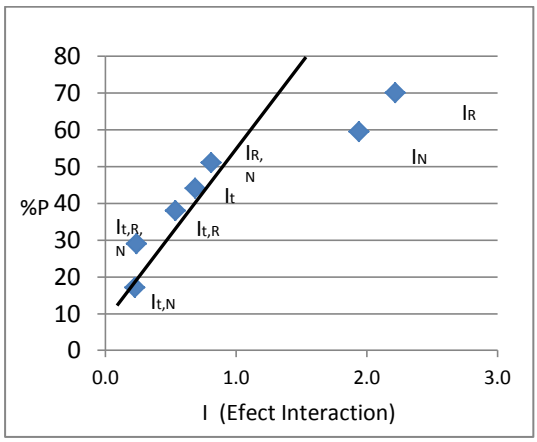


Figure 2: %P vs I.

After analyzing using the factorial design method, the material and solvent ratio (R) is the most influential variable, because it is located farthest from the approach line on the distribution curve.

Next, optimization of various material:solvent ratios under operating conditions 120 minutes (t) and material size 80-100 mesh (N) as shown in Figure 2.

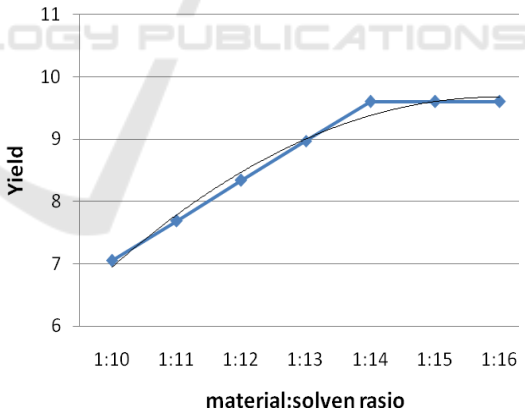


Figure 3: Optimization material:solven ratio.

Figure 3 shows clearly that the greater the amount of solvent than the amount of material, the greater yield will be produced. The greater dyes yield is obtained because the solvent's solubility ability to extract dyestuffs in the onion skin is better and provides greater opportunities between solvents and ingredients to touch.

The solubility of dyes will continue to increase with the amount of the material ratio and the extraction solvent until saturation occurs in the solvent. Material and solvent ratio of 1:14 (50 grams: 700 ml), yield has not increased again. This is due to saturation of the solvent concentration so that the diffusion process between the material and the solvent occurs very slowly. So that the addition of a larger solvent will not add to the extraction power of the dyes in the extraction process.

Another factor that influences the high and low yield produced in this extraction process is the size of the material. In this study using the material size of 40-60 and 80-100 mesh, after the experiment it was seen that the use of material sizes with 80-100 mesh gives higher yields compared to the use of material sizes with 40-60 mesh. This is because the surface area of the extracted material is getting larger so the greater the chance for the material to interact with the solvent, so that the solvent can extract more.

4 CONCLUSIONS

The results of the study and observations concluded that the variables that most influence the yield of dyes from onion skin waste are the ratio of materials and solvents. The greater the ratio of materials and solvents, the greater the yield value. The optimum ratio value is 1:14 with extraction time of 120 minutes, particle size of 80-100 mesh and a yield of 9.6%.

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