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Application of Morning Glory Flower (*Ipomea purpurea*) Extract for Colouring Plant Section Preparation

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A B S T R A C T

Background: Preparing requires colouring to clarify or sharpen various tissue parts, especially cells. The use of synthetic dyes in preparations in the long term can less impact both living things and the environment. The study aims to obtain natural dyes from morning glory flowers at optimal temperatures and pH and find out the feasibility of preparations coloured using Morning Glory flower extract. **Method:** The extraction process uses a maceration method with different temperature variations of 400C, 500C, 600C, 700C, 800C and different pH i.e. 3, 4, 5, 6. The preparation process uses different dye concentration variations. The concentrations used are 50%, 60%, 70%, 80%, 90%, 100%. Data analysis techniques use descriptive and percentage analysis methods. **Results:** Morning glory flower extract (*Ipomoea purpurea (L.*) Roth) can colour dermal tissue, empulur, cortex and transport beams on the stems of cayenne pepper plants (*Capsicum frutescens L.*). **Conclusion:** Natural dyes of morning glory flowers can be used as a learning medium with a 74% eligibility rate for preparing with morning glory flower dyes.

Aplikasi Ekstraks Pewarna Alami Bunga Morning Glory (*Ipomoea purpurea*) pada Preparat Section

Kata kunci:
Batang Cabai Rawit;
Bunga Morning glory;
Kelayakan Preparat;
Pewarna Alami;

A B S T R A K

Background: Pembuatan preparat membutuhkan pewarnaan untuk memperjelas ataupun mempertajam berbagai bagian jaringan, terutama pada bagian sel-selnya. Penggunaan pewarna sintetis pada preparat dalam jangka panjang bisa berdampak kurang baik pada makhluk hidup maupun lingkungan. Tujuan penelitian untuk mendapatkan pewarna alami hasil ekstraksi dari bunga morning glory pada suhu dan pH yang optimum serta mengetahui kelayakan preparat yang diwarnai menggunakan ekstrak bunga Morning Glory. **Metode:** Proses ekstraksi menggunakan metode maserasi dengan variasi suhu yang berbeda yaitu 400C, 500C, 600C, 700C, 800C dan pH yang berbeda yaitu 3, 4, 5, 6. Proses pembuatan preparat menggunakan variasi konsentrasi pewarna yang berbeda. Konsentrasi yang digunakan yaitu 50%, 60%, 70%, 80%, 90%, 100%. Teknik analisis data menggunakan cara deskriptif dan analisis persentase. **Hasil:** Ekstrak bunga morning glory (*Ipomoea purpurea (L.*) Roth) dapat mewarnai jaringan jaringan dermal, empulur, korteks dan berkas pengangkut pada batang tanaman cabai rawit (*Capsicum frutescens L.*). **Kesimpulan:** Pewarna alami bunga morning glory dapat digunakan sebagai media pembelajaran dengan tingkat kelayakan 74% untuk preparat dengan pewarna bunga morning glory.

Introduction

The availability of quality plant tissue preparations becomes very important in microscopic study. Colouring techniques become one thing that is very important in the manufacture of preparations. In preparations, colouring is needed to clarify or sharpen various tissue parts, especially in the cells. During this time, the manufacture of preparations is still very dependent on synthetic dyes. Nevertheless, lately, people worldwide are starting to worry about the negative health impacts of synthetic chemicals used as dyes. The use of carcinogenic synthetic dyes can cause skin allergies that can even develop into skin cancer resulting in environmental pollution (Tisnadjaja, 2014; Wilujeng & Kusnawati, 2010; Zulfiyah et al., 2015). This encourages attention to return to the utilization of natural dyes.

Each part of a plant that is coloured contains pigments that can be used for natural dyes in place of synthetic dyes that hurt the health and the environment. This ability can be determined by the intensity of the colour obtained and depends on the type of colouring mater. The extraordinary ability in colouring tissue by its nature is owned by natural colour substances (Wismaji et al., 2010).

Morning Glory flowers have attractive colours, containing anthocyanin pigments soluble in polar solvents, environmentally friendly, and potential for natural dyes. Natural dyes have other advantages of not being toxic, easily degraded and environmentally friendly. In addition, non-toxic natural dyes do not cause allergies to the skin. They can be found around the environment, making it cheaper and easier to be able to, and waste can be used as fertilizer for plants (Kulkarni et al., 2011; Kumaresan et al., 2011; Pujilestari, 2015).

Anthocyanins belong to the flavonoid group (Andarwulan & Faradila, 2012). Plants that contain anthocyanins are usually characterized by red, blue or purple. These colours can be found in vegetables, fruits, ornamental plants and wild plants. One example of plants that are often found in the yard of the house or grow wild is Ipomoea purpurea which has purple flowers containing anthocyanins in the form of cyanidin and pelargonidin (Meira, Pareira, & David, 2012).

According to Priska, Peni, Carvallo, & Ngapa (2018) and Lu *et al.* (2009), the *Ipomoea purpurea* (L.) Roth flower section contains anthocyanins amounting to 3.31 to 5.31 µg/mg. The content of Morning Glory flower extract is used as a pure dye without any other reagent mixture. Utilization of natural dyes through the extraction process at a more affordable cost and can reduce the increasing amount of waste (Santoso & Kiki, 2017).

Previous research has been conducted, including morning glory leaves for textile dyes (Zulfiyah et al., 2015). Natural colour is obtained by extracting raw materials that will be used with adjusted solvents (Haerudin et al., 2017; Wahyuni et al., 2020). Solvents have properties that are not corrosive, selective, and there is no reaction between the solvent and the material to be extracted. High solvent power is not toxic. It has low viscosity (Sudarmi et al., 2015). Various factors can affect the stability of anthocyanins, namely pH, oxygen, enzymes, temperature, light, deviations, oxidizers (Hidayah et al., 2014).

Natural colour substances have the disadvantages of a limited colour spectrum, colour is volatile, easy to wear and dull, but natural dyes are affordable, safe and do not pollute the environment. Natural colours are stable at a certain pH and temperature. Therefore, finding alternative dyes at the right temperature and pH conditions (Saati, 2010).

Thick and large plant parts can be made to prepare slices (sections) to facilitate the observation of cells and tissues using a microscope (Wahyuni, 2009; Moebadi & Yudani, 2011). The anatomical structure of dicot and monocot plants can be learned by making preparations using the section method. They colour the preparation with morning glory, beginning a flower extract to clarify the plant cells in the preparation section. Without colouring, observations on the preparation of animal and plant tissues are relatively challenging to do (Wahyuni, 2009).

The availability of suitable plant and animal tissue preparations will significantly support biology learning in school. The impact of the dangers posed to synthesis dyes encourages natural colouring in the manufacture of preparations. This research aims to obtain natural dyes from morning glory flowers at optimal temperature and pH and find out the feasibility of preparations coloured using Morning Glory flower extract.

Methods

Scope of Research

This study included qualitative descriptive research, which described the utilization of morning glory flower extract (*Ipomoea purpurea, L. Roth*) as a natural dye and the preparation of slices of the cayenne pepper plant (*Capsicum frutescens L*). The research was conducted at the Materia Medica Phytochemical Laboratory in Batu City and the Chemistry-Biology Laboratory of the University of Muhammadiyah Malang.

Sample

The study sample used Morning glory flowers that grow in rice fields and roadside Batu City which was then used as a natural dye, and cayenne pepper stems (*Capsicum frutescens L*) obtained from the rice fields of Batu city, which were then made preparing a plant section. The sampling technique used is simple random sampling by taking cayenne pepper stems randomly cayenne pepper stems at the rice fields of Batu City.

Suhu ^{0} C	Extract Morning Glory Flowers		
	Colour	Absorbance	λ nm
40^o	purplish blue	2,883	641
50^o	purplish blue	2,886	641
60^o	purplish blue	2,874	641
70^o	purplish blue-	2,870	641
80^o	purplish blue-	2,864	641

Instruments/Tools

Research using extraction equipment, blenders, rotary evaporators to obtain extract results and UV spectrophotometers are used to determine the absorption of Morning glory flower extracts. Microtomes and binocular microscopes to produce rod section preparations and observations.

Research Procedure

The research procedure is carried out with four stages: plant determination, dye extract making, preparation making, and media review. Extraction is carried out using the maceration method (Sudjadi, 1986; Nugroho, 2017). To find out the absorbance of morning glory flower extract using a UV-Vis spectrophotometer at wavelengths of 400-800 nm (Amin, 2017). Extraction is performed with variations in pH (3,4,5,6), as well as different temperature treatments (400, 500, 600, 700, 800). The results of the extraction of natural dyes of morning glory flowers with the best treatment (pH and temperature) are further used as dyes to colour the stem tissue of cayenne pepper with different concentrations The procedure of making preparations through the steps of making preparation section (Wahyuni, 2016).

Result

Results of Extraction and Natural Coloring Stability Test of Morning Glory Flowers

pH	Extract Morning Glory Flowers		
	Colour	Absorbance	λ nm
3	purplish blue	0.390	641
4	purplish blue	0.395	641
5	purplish blue	0.169	641
6	purplish blue-	0.069	641

The extraction of natural dyes of morning glory flowers produces a purplish-blue colour with a wavelength of λ 641 nm. The results of the study related to the different pH treatments of the natural dye of morning glory flowers presented in Table 1 and the treatment of temperature differences shown in Table 2 as follows:

Table 1. Data Absorbance of Morning Glory Flower Extract at Different pH

Table 2. Data Absorbance of Morning Glory Flower Extract at Different Temperatures

The morning glory flower's natural colour stability test results at pH treatment of 3,4,5,6 were dissolved in a citric buffer at λ 641nm, resulting in the highest absorbance value of 0.395 at pH 4. At temperature treatment 400, 500, 600, 700, 800 Celsius, it produces a top absorbance value of 2,886 at 500 C.

Preparing Feasibility Test with Morning Glory Flower Natural Dye

The feasibility test of preparation with natural dyes is carried out by observing the Clarity and contrast of the preparation in each treatment with a score range of 1-5. Then the average of the two components is divided by five multiplied by 100%. The test results are presented in Table 3.

Table 3. Results of Feasibility Test Preparing Cayenne Pepper sticks with Natural Dye Morning Glory Flowers

Concentration Treatment (%)	Average of Morning Glory flower dye in Preparation Quality			Description
	Score Clarity	Score Conflict	Eligibility %	
50	3.10	3.30	64.00	Decent Enough
60	3.70	3.20	69.00	Decent Enough
70	3.55	3.55	71.00	Decent
80	3,55	3,45	70.00	Decent Enough
90	3.80	3.40	72.00	Decent
100	4.00	3.40	74.00	Decent

Description: Range Score: 1-5, Clarity (1: Unclear 2: Less Clear 3: Quite Clear 4: Clear 5: Very Clear). Contrast (1: No Contrast 2: Less Contrast 3: Enough Contrast 4: Contrast 5: Very Contrast) and Eligibility (1-40: Unworthy 41-55: Less Worthy 56-70: Sufficient 71-85: Worth 86-100: Very Decent).

Discussion

The extraction of natural dyes of morning glory flowers at pH treatment and different temperature treatments produces a purplish-blue colour at a wavelength of λ 641 nm. The natural colour stability test results of morning glory flowers resulted in the highest absorbance value pH four, obtained 0.395 (Table 1), the highest absorbance value at temperature 500 obtained 2,886 (Table 2). There is a change in colour gradation followed by a difference in absorbance values. Each part of a cell or tissue has unique properties, so the affinity of these parts to colour substances also varies. Colour substances themselves have a remarkable ability in colouring tissues with their properties (Brata, 2013). In addition, the Clarity and contrast of colour are also influenced by various factors such as solvent type, temperature, pH and different lengths of immersion (Bisri et al., 2014). According to Pujilestari, colour stability is at 50o and acidic pH (Pujilestari, 2015).

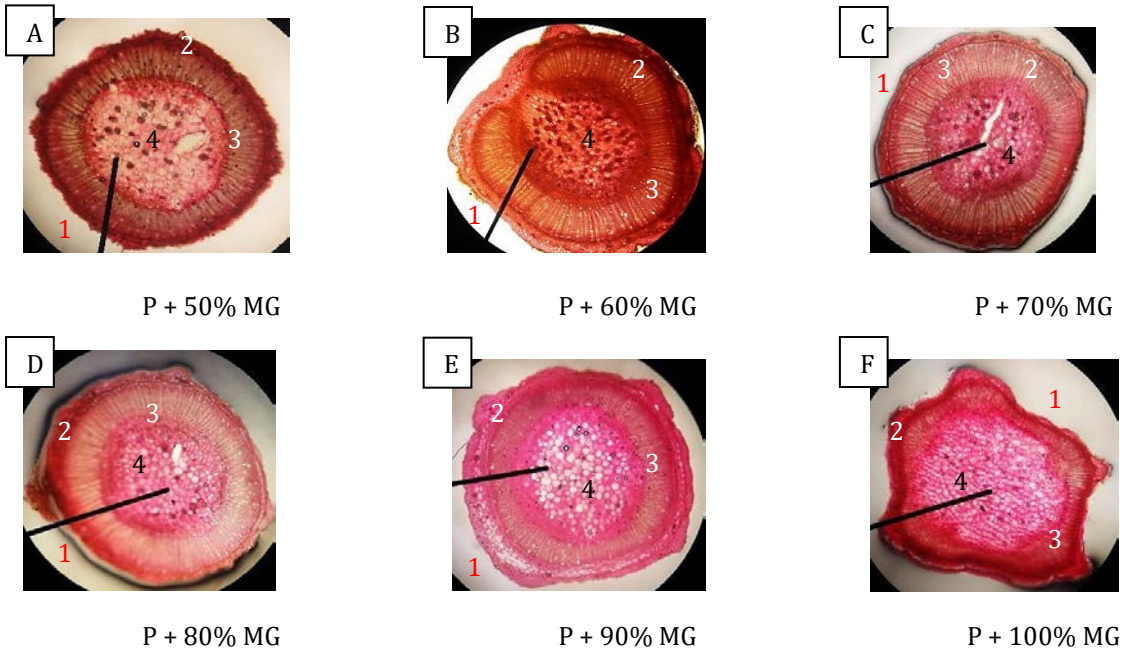

Figure 1. Cross-section of cayenne pepper stalks (*Capsicum frutescens L.*) (P) with Morning Glory Flower (*Ipomoea purpurea (L.*) Natural Dye with 100x magnification

They are colouring the preparation of cayenne pepper stem tissue using natural dye morning glory flower extract, with a pH of 4 and a temperature of 500 Celsius with different concentrations (50%, 60%, 70%, 80%, 90% and 100%) as presented in Table 3. Produce preparations with eligibility rates ranging from 64.00% to 74.00%. Each dye concentration produces a different contrast and Clarity at each stage and makes a different preparation. The results of the feasibility test showed the best eligibility of 74.00%. This means that morning glory flower extract can colour plant tissues well and decently according to a predetermined rubric (Table 3).

The constituent tissues visible in the preparation are the epidermis, cortex, transport beams (xylem and phloem) and empulur, as presented in Figure 1. Staining in the preparation can occur because the reaction of electrostatic bonds between the ion charge of acidic colour substances will release a positive control. The base part of the network will remove a negative ion charge so that the tissue can be coloured. Anthocyanins that are acidic will colour the alkaline component of the tissue (Bisri et al., 2014). The results of colouring the preparation of cayenne pepper stems with morning glory flower extract showed that each part of the tissue on the chilli stem absorbed different colours (Figure 1).

Preparing slices of cayenne pepper stalks with 100% morning glory extract dye (Figure 1.F) produces Clarity of preparation with a clarity score of 4.00. The preparation shows that the epidermal tissue, cortical tissue, transporting tissue and other strengthening tissues is apparent compared to the preparation of slices of other cayenne pepper stems. While preparing with 70% morning glory extract dye (Figure 1.C) produces better colour contrast with an average score of 3.55 than other treatments. This indicates that the affinity for colour substances in each tissue part is not the same. Colour substances themselves have unique properties and abilities in colouring tissues (Brata, 2013). In addition, the Clarity and contrast of colour are also influenced by various factors such as solvent type, temperature, pH and different lengths of immersion (Bisri et al., 2014). According to Aknesia (2013), acidic colour substances colour the part of the alkaline cell and vice versa. Alkaline colour substances colour the part of the cell that is acidic. Nurwanti, Budiono, Pratiwi, & Rinie (2013) suggested that anthocyanins with an acidic pH colour the walls of cellulose cells with an alkaline pH. Positive ions in the substance will be released and covalently bonded with the negative ions present in the cell wall of plant tissues.

Conclusion

Natural colouring extraction of morning glory flowers (*Ipomoea purpurea (L.*) Roth) is optimal at 50oC and pH 4 (acid). At 50 ^{o}C, it has an absorbance yield of 2,886, and at pH four, it has an absorbance yield of 0.395. Furthermore, in the preparation section of the stem of the cayenne pepper plant (*Capsicum frutescens L.*), using natural dyes from morning glory flower extract has the best feasibility of 74% so that the preparation is suitable for use as a natural dye preparation because it has a >70% eligibility rate.

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Declaration statement

The authors reported no potential conflict of interest.

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