Natural paint development using local flora

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ABSTRACT

The objective of this research was to extract the pigments of these waste flowers and use it to produce a natural paint that can be used for frescoes in religious locations as a community service project. The Soxhlet extraction method has been utilized to extract colorants from the flower petals using various inorganic and organic solvents. Many flowers failed to give a sufficient color yield to develop a paint while pigeonwing flowers produced enough pigment extraction to produce a sky-blue color paint.

INTRODUCTION

Local flora such as the lotus types and Lilies are disposed daily in large amounts at certain religious locations of Sri Lanka such as the Buddhist temples in Anuradhapura, Polonnaruwa, Kelaniya and Dambulla. These flowers possess beautiful natural colors and tempting fragrances which could be extracted and used for many productive applications. Although none of this useful organic waste is utilized in Sri Lanka in such a way. Therefore, the main objective of this research is to develop a paint using natural colors extracted from these local flowers removed as waste in tons, from religious places. The goal is to use the developed paints on religious frescoes around Sri Lanka as a first step before commercialization.

METHODOLOGY

The selected flower was cleaned and cut into small pieces to increase the surface area of contact with the solvent. 200g of flower petal pieces were inserted into the thimble of the Soxhlet extraction unit. 250ml of the selected solvent was added to the heating unit. At least 4-5 cycles of liquid depending on the solvent were facilitated in order to increase the extract yield. At each cycle, a sample of extract was taken from the Soxhlet and was measured for its absorbance using the spectrophotometer. The experiment is supposed to be stopped when the absorbance becomes a constant as the extract would be saturated in the solvent at that point. Using the spectrophotometer data, the pigment concentration profiles were plotted per each flower used in the experiment. The concentrated pigment (dye) was stored in a secure place not exposed to direct sunlight after adding antioxidants.

The extract needs to be combined with anti-oxidants and other preservatives. In order to develop a paint, following parameters are considered. Binding of the paint with the application surface. Opacity of the final product. High sheer viscosity. Density. Drying time. Sagging. Bubbling. Weather\oxidation resistance.

The extracted pigment is added to 500ml of a binder which is an anionic emulsion polymer called Achronal 7035. The mixture is agitated until its color is uniform. Density and viscosity of the mixture are measured. If the values are not within the required range, relevant filling materials are added to correct the density and viscosity. Preservatives are being added. A drawdown application is being done on a hiding power chart. The hiding power chart is dried and observed for opacity and basic appearance (Visual

inspection). If the following issues are observed with regard to Opacity, bubbling, cracking, drip marks, adhesion, necessary corrections should be followed by adding additives. Pigment concentrations are changed in the paint until the required color is obtained. (Color matching). A wall application is performed and the paint will be rechecked for Opacity, bubbling, cracking, drip marks, adhesion and sagging up to 8 hours from the application time. A wear test is performed using the wet abrasion scrub tester. The paint is again applied on a draw down chart and exposed to simulated sunlight, rain and varying weather conditions. The weathering test is carried to evaluate the paint's resistance to UV rays and humidity up to 7 days. Salt is added to the flooding unit to simulate the paint in salty environments. Once the paint has passed all these tests and performs within the required standard, it is approved and can be used on frescoes applications.

RESULTS AND DISCUSSION

After performing the extraction steps for various flowers with different solvents, we could obtain the following results [Table 1].

Therefore, water is the best solvent for the extraction of the blue pigment in the pigeonwing flower [Figure1].

When the absorbance of the pigeonwing flower was measured with respect to the weight of the flower petals the absorbance values rose up without reaching to a saturation point as the total mass of pigeonwing flower was used [Figure2]. From all the flowers that can be collected from the religious places, it is one of the rarest flowers that can be found.

Even though the pigment extract showed a strong dark blue color, when it was mixed with the binder it showed a color closer to sky blue. Since it produces a light blue color it reduces the spectrum of blue colors.

Flower	**Acetone**	**Water**	**IPA**	**Methanol**	**Ethanol**	**Hexane**
Pigeonwing	Successful	Deep blue color. Highly successful	Successful	Successful	Successful	Unsuccessful No extraction
Trumpet flower	Successful. Transparent yellow color.	Poor extraction	Poor extraction	Poor extraction	Poor extraction	Successful. Transparent yellow
Red lotus	Poor extraction	Poor extraction	Poor extraction	Poor extraction	Poor extraction	No extraction
Marigold	Moderately successful	Moderately successful	Less successful than methanol	Successful	Less successful than methanol	Moderately successful
Frangipani	Unsuccessful	Unsuccessful	Unsuccessful	Unsuccessful	Unsuccessful	Unsuccessful
China rose	-	Successful	-	-	-	-
Blue Lotus	Successful	Successful	Moderately successful	Moderately successful	Moderately successful	Unsuccessful
Jungle geranium	Unsuccessful	Unsuccessful (Dark color extract)	Unsuccessful	Unsuccessful	Unsuccessful	Unsuccessful
Allamanda	Successful. Transparent yellow color.	Poor extraction	Poor extraction	Poor extraction	Poor extraction	Successful. Transparent yellow

Table1: Solvent-Flower extraction compatibility test result

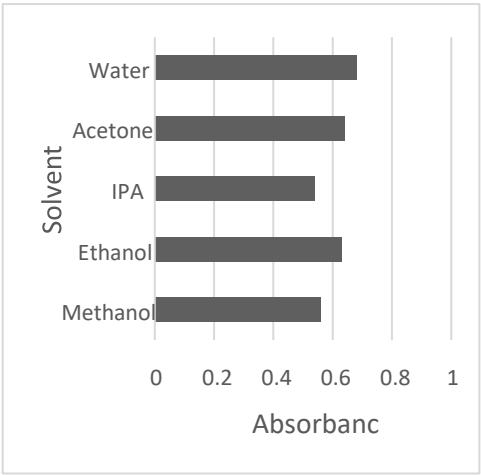

Figure 2: Absorbance of the pigeonwing flower pigment in different solvents

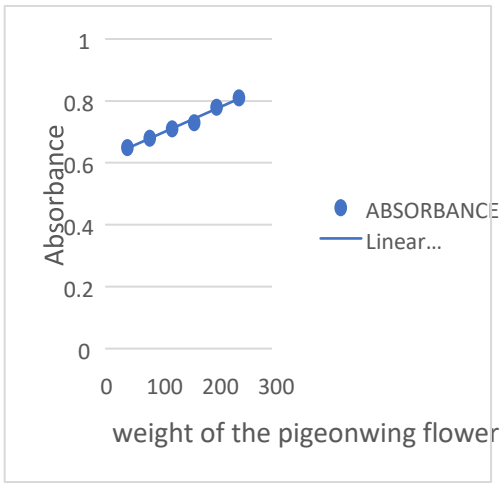

Figure 1: Absorbance vs Concentration - Pigeonwing flower

CONCLUSION

The results indicate that even though large amounts of flowers get disposed every day, the amount of colors that can be extracted from these flower petals are very limited. Most of the disposed flowers are white in color and they cannot be used for pigment extraction. A viable option for paint manufacturing is pigeonwing flower from which a deep blue color can be extracted using water. Using this blue color extract, a sky-blue color paint can be manufactured. But the amount of pigeonwing flowers obtainable from temples and other religious places is quite limited and hence we cannot go for a larger production capacity. This applies to all other flowers which have the slightest potential to extract to colorants. Therefore, natural paint development from waste local flora is not feasible and in order to produce sufficient amount of paints from flora, one would have to grow and harvest the flowers.

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Keywords: Natural paint; Petal paint; Pigment extraction