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Pusat Asasi

Plants bASed highlighTER peN (PASTERN)

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ABSTRACT

Highlighter pens serve as vital tools for office and education to mark important information and concepts for memory. Most highlighter kinds use liquid ink and function similarly to felt-tip pens or markers. However, conventional highlighters may be harmful to contend with because they consist of artificial colours created chemically such as fluorescein, pyranine, triphenylmethane, rhodamine, xanthene, and coumarin. The main objective of Plants bASed highlighTER peN (PASTERN) is to create non-toxic highlighter using natural colouring that has been extracted from plant base. For the innovation development of the product: turmeric, butterfly pea flower, and coffee powder have been used as colouring agents and become excellent replacements for the toxic substances found within conventional highlighter pens. Each plant base extract's components have been identified using the retention factor (Rf) in chromatography. While butterfly pea flowers had a higher Rf value and less polarity, turmeric extract had a lower Rf value and was more polar. Moreover, caffeine exhibited a more polar, concentrated solution behaviour, and lower Rf value. Plant base extract can be utilized as a natural colouring agent in highlighter pens by employing each aspect that was examined. By doing so, hope PASTERN will establish itself as a non-toxic, environmentally friendly stationery option in the future.

Keywords: Plants based; highlighter pen; eco-friendly; non-toxic

INTRODUCTION

Highlighter pens have a particular ink made to be seen clearly when writing over already-existing text or writing. This will enable us to draw attention to any textual passages that are particularly compelling or important. The study regarding chemicals as colouring agents in highlighter pens still lacks information regarding the chemical contained within synthetic and natural colouring. Most highlighter kinds use liquid ink and function similarly to felt-tip pens or markers. However, conventional highlighters may be harmful to contend with because they consist of artificial colours created chemically such as fluorescein, pyranine, triphenylmethane, rhodamine, xanthene, and coumarin.

The main objective of Plants bASed highlighTER peN (PASTERN) is to create non-toxic highlighter using natural colouring that has been extracted from the plant base. While in the beverage industry, the study of food colouring is important as people are more attracted to colourful food which gives the most significant sensory attribute [1,2]. Thus, the study on the preparation of colouring agents for plants-based highlighter pens (PASTERN) will let us know the chemical substances for each type of colour that can contribute to the work, educational, and beverage industry.

MATERIAL AND METHODS

Sample Preparation

Sample preparation is the fundamental stage in preparing colouring agents for plants-based highlighter pens (PASTERN). For the innovation development of the product: turmeric, butterfly pea flower, and coffee powder have been used as colouring agents and become excellent replacements for the toxic substances found within conventional highlighter pens.

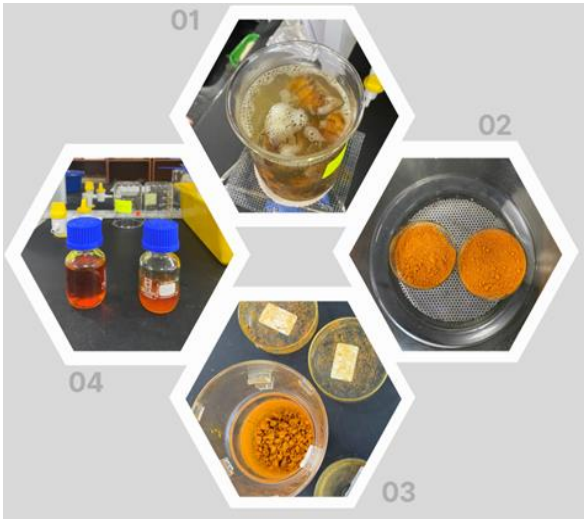

Figure 1: Turmeric extraction

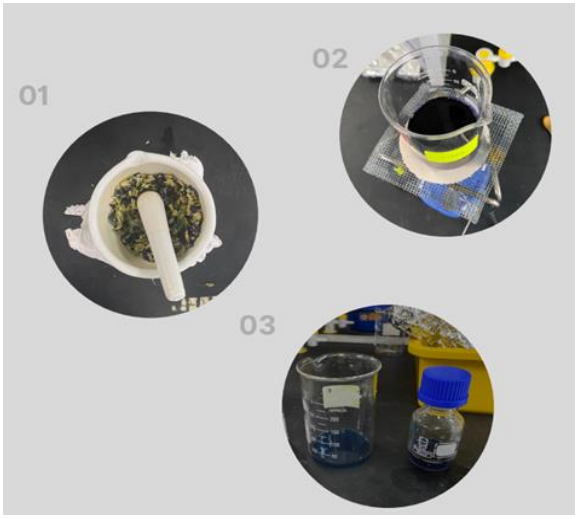

Figure 2: Butterfly-pea flower extraction

The colouring agent was prepared using the extracted of turmeric as in Figure 1. To begin with, the ingredients were boiled in water by using a beaker, Bunsen burner, clay triangle and wire gauze. Next, cut it into small pieces and dried it in a food lab dehydrator to preserve this turmeric by removing the moisture. All dehydrated foods are then ground by using the dry blender to give a deep orange-yellow powder and placed in an airtight food storage container and stored in a cool, dry place. After that, the combination of 20 ml of water and 30 g of ground ingredients was boiled for 2 hours. 50% of ethanol was added to the boiled mixture and left for a day. The final step for extraction was to filter the brewed liquid using filter paper to separate fine solid particles from the liquid. Then, it is ready to undergo the chromatography test part.

For the colouring agent from butterfly-pea flower, the extraction is shown in Figure 2. To begin with, collect the plant materials and clean the samples. Next, dried it by using a food dehydrator and then crushed it. After that, dissolved it in boiling water for 2 hours for quick extraction. At the end of 2 hours, the total colour was extracted [3]. Leave it for a night and after that remove the flower. Use filter paper to separate fine solid particles from liquids. Then, it is ready to undergo the chromatography test part.

The next colouring agent was prepared using the extracted of caffeine as in Figure 3. To begin with, 9 grams of coffee powder was dissolved in 50 ml of boiling water for 2 hours. Then, filter it by using filter paper to separate the fine solid particles from the liquid ones.

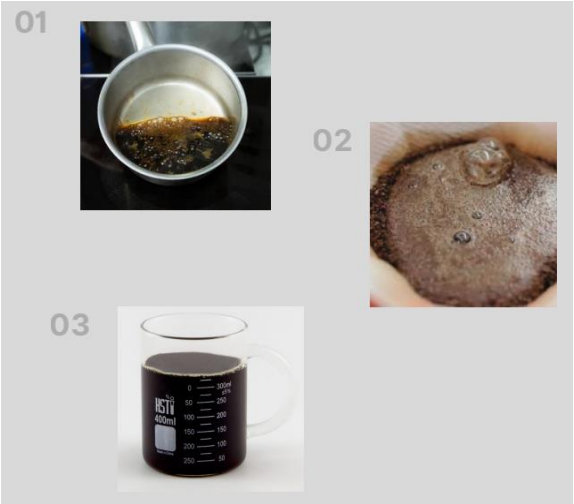

Figure 3: Caffeine extraction

Chromatography Test

All the plant-based extracts (turmeric, butterfly-pea flower, and coffee) have undergone the chromatography test. Chromatography is a technique that is used to separate and identify components of a mixture. In this study, the main objective of the chromatography test is to measure and calculate the Rf value and determine the polarity of the sample as in the step shown in Figure 4.1 until Figure 4.4.

Figure 4.1 Take a strip of chromatography paper and make a line around 1-2cm.

Figure 4.2 Drop the colour at the labelled line.

Figure 4.3 Developer solution (isopropyl) should be poured into the beaker and let rise.

Figure 4.4 Label and calculate the retention value.

RESULTS AND DISCUSSION

In this study, the calculation of retention value (Rf value) has been used to determine the polarity of the sample extractions. As in Table 4, the butterfly-pea flower shows Rf value of 0.95 which same as the expected result from the previous study [4]. Based on the outcome, it is feasible to say that the chemical content and the polarity of the butterfly-pea flower extraction were non or less polar. In addition, high retention factor value means strong interaction between the compound of interest and the surface. Dye extraction from turmeric shows a colour with Rf value of 0.39 which same as the expected result from the previous study [5]. During the process, all the components of the mixture move slower from the baseline so the Rf value (retention value) of the solvent will be lower during the chromatography process. It can be concluded that the chemical contains, and the polarity of the turmeric extraction was higher.

The last dye extraction was from coffee. It shows a colour with Rf value of 0.36 which is different from the expected result from the previous study [6]. In the previous study, the result was 0.80. The reason why the result of Rf value is different from the expected result is that the amount of solute that has been used is more than the solvent compared to the expected result. Hence, from the data obtained, all the components of the mixture travel slower so the Rf value of the solvent will be lower during the chromatography process. From the result obtained, it can be concluded that the chemical content and the polarity of the caffeine extraction were higher while the Rf value was lower. A low value of the retention factor means the interaction between the compound of interest and the surface is weak.

Table 4: Rf value of paper chromatography for three different extractions

Natural Dyes Extract	Rf Value
Turmeric	0.39
Butterfly-pea flower	0.95
Caffeine	0.36

CONCLUSION

Plant-based extraction is available to use in various industries either work, educational, or beverage industry. In this study, the extraction of natural colouring has been implemented in highlighter pens. Its cost-effective strategy, free from harmful chemicals and last longer made PASTERN will establish itself as a non-toxic, environmentally friendly stationery option in the future.

REFERENCES

[1] Gandhi, N., (2019). Food Colours and their Chemistry. Journal of Agricultural Engineering and Food Technology, Volume 6 (Issue 2), Page Number (129-132)
[2] Dey, S., & Nagababu, B. (2022). Applications of food colour and bio-presentative in the food and its effect on the human health. Journal of Food Chemistry Advances, Volume 1(Issue 3), Page Number (172-174).

[3] R.Ravindran, D., & Bharathithasan, M., et al. (2020). Chemical composition of flower extracts from *Clitoria Ternatea.*
[4] Omokpariola, D. O. (2019). Group Practical and Term-Paper on "Paper Chromatography". August 2019, https://doi.org/10.13140/RG.2.2.28961.33121
[5] Khan, S., & Khamar, D. (2019). Development and Standardization of Turmeric Cream HPTLC. International Journal of Biomedical and Advance Research, Volume 1(Issue 4), Page Number (109-116).
[6] Abidi, S., & Gilani, Umer., et al. (2020). Extraction and analysis of caffeine from various brands of tea leaves marketed in Pakistan. Journal of Pharmacognosy and Phytochemistry. Volume 9 (Issue 1), Page Number (9-10).
[7] Fortunado, I., (2019). The seven primary colours. International Journal of Advanced Education and Research, Volume 4 (Issue 4), Page Number (13-14).
[8] L. Escuder-Gilabert, J.M. Bermúdez-Saldaña, R.M. Villanueva-Camañas, M.J. Medina-Hernández, S. Sagrado (2004). Reliability of the retention factor estimations in liquid chromatography. Journal of Chromatography A. Volume 1033 (Issue 2) Page Number (247-255)