

Extraction Optimization of Natural Dye from *Clitoria Ternatea* Flower by OFAT

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Abstract— Dyes are widely used in industries such as textiles, leather, paper, and plastics to colour their final products. This paper highlights an on-going study which the scope is to optimize the extraction of natural dyes from the natural sources. The objective of this study is to determine the optimum conditions of extraction natural dye where the parameters for extraction of natural dye are temperature, solid liquid ratio and time with one factor at one time (OFAT) by utilizing Design Expert V8.0.6. In this research, *Clitoria Ternatea* flower will be used as the source of natural dyes. The pigment that is contained in *Clitoria Ternatea* flower called delphinidine. The objective of OFAT was to study the effect reaction of extraction on the *Clitoria Ternatea* flowers were temperature, time and solid liquid ratio. The extraction temperature at 60 °C contributed to the maximum adsorption of delphinidine. The absorption of delphinidine was higher at time 20minutes and then it reached while the absorbance was increased until solid liquid ratio 1:10.

Keywords— *Natural dyes, Clitoria Ternatea, Delphinidine, Extraction, One factor at one time (OFAT)*

1. INTRODUCTION

Natural dyes obtained from plants can produce rich and complex colours [2]. The whole spectrum of colours can be obtained from a multitude of plants, animals and fungi, to dye clothes, textiles and artifacts, and to colour our skin, our hair and the food we eat. The discovery and use of natural dyes and pigments contributed to the maintenance of the age-old bond between humankind and nature and could now help to revive and enhance it [1]. The advantages of natural dyes are cost effective, renewable, non-carcinogenic in nature and cause no disposal and allergic problems. As a result, there is a great demand for natural dyes since they do not pose health hazards [9]. The natural dyes extract that selected for this study is delphinidine pigment which extracted from *Clitoria Ternatea* flower. *Clitoria ternatea* flower is one of our candidates in the studies of

floral anthocyanins. *Clitoria ternatea* L. Fabaceae a perennial climber herb, commonly known as butterfly pea, is distributed in tropical countries [5]. The blue color of butterfly pea flowers comes from anthocyanins which are classified as ternatins [8]. Anthocyanins are normally obtained by extraction from plants and the extraction methods currently employed are with the use methanol, ethanol, acetone, water or mixtures as solvents. However, the stability of these anthocyanins is easily affected by structural modifications with hydroxyl, methoxyl, glycosyl, and especially acyl groups and by environmental factors such as temperature and light [10]. From this research, *Clitoria Ternatea* flower is selected because it is widely used throughout the history and it's also have good colourfast properties. In addition, it can be easily obtained from anywhere. The harmful effects of synthetic dye and chemicals used at the time of dyeing have forced to concern about the alternative preparation of dye using natural sources.

2. EXPERIMENTAL PROCEDURE

A. Materials Description

The *Clitoria Ternatea* flowers were obtained from the backyard at my house and neighbour at Taman Mahkota Aman, Kuantan Pahang. The raw material was kept dried in the oven at laboratory and then was grinded. The raw material was then grinded into small pieces.

B. Extraction of Natural Dyes

Natural dye was prepared by using water extraction. The purpose of using water extraction is to make sure that the colour is safe from the chemical and harmful substance. *Clitoria Ternatea* flowers was first cleaned and dried in oven at low temperature in order to remove all the moisture content in the flower. Then, the flower was grinded into small pieces, about 1mm, to increase the surface area. Then, the blue natural dye was extracted by applying ratio 1:10 corresponding to the ratio of 1 g of raw material to 10 mL of water. The mixture was then centrifuged at 4 °C, 10000rpm for 15 minutes [2]. The mixture was filtered to collect the supernatant dye. Finally, filtration of the supernatant was done by using stainless steel filter paper. The resulting extract was used for the further experiment.

C. Optimization of Extracted Natural Dyes

The preparation of natural dyes sample was done as the same procedure by changing one of parameters which called OFAT. OFAT studies were carried out to determine specific level of each parameter. OFAT is the most extensively used experimental strategy for optimization process [4]. Moreover, OFAT is relatively simple and straight forward experimental plan, which does not require advance statistical knowledge [6]. The extraction of natural dyes samples were undergo OFAT in order to obtained the optimum conditions of extraction natural dyes for solid liquid ratio/concentration, temperature and time. The readings of absorbance for all samples were measured using UV-VIS Spectrophotometer and recorded. Table below shows the OFAT analysis for extraction of *Clitoria Ternatea* flowers.

3. RESULTS AND DISCUSSIONS

The results on effect of three parameters of *Clitoria Ternatea* flowers extracts were obtained from OFAT which the conditions applied stated in Table 1 where the parameters involved were temperature, time and solid liquid ratio. The extraction was done using distilled water as the solvent. The effect of temperature on extraction of turmeric is demonstrated in Fig.1. As can be observed, the absorption of *Clitoria Ternatea* flowers increases with increase of extraction temperature and reaches a maximum value at 60 °C then it decreases. This increase in dye uptake can be attributed to better dye exhaustion at higher temperatures. However, temperature higher than 60 °C results in decrease in colour strength and attributed decomposition of delphinidine at higher temperature. Effect of time on extraction of *Clitoria Ternatea* flowers is shown in Fig.2. The longer the extraction time, the higher of absorption delphinidine until dye exhaustion reached equilibrium and there is decrease in absorption after further increase in time over 20 minutes. The decline in absorbance is attributed to the decomposition of delphinidine at longer time at 60 °C. Fig. 3 shows the effect of solid liquid ratio on extraction of *Clitoria Ternatea* flowers. It is clearly shown that the increases of liquid added into the 1g of solid *Clitoria Ternatea* flowers, the increases of absorbance which more delphinidine absorbed until solid liquid ratio 1:10 then it decreased.

Table 1: OFAT for Extraction of *Clitoria Ternatea* flower
***Clitoria Ternatea* flower**

Temperature, °C	: 30,40,50,60,70,80
Solid liquid ratio, g/mL:	1:20
Time, min	: 10
Solid liquid ratio, g/mL:	1:5,1:10,1:20,1:30,1:40,1:50
Time, min	: 10
Temperature, °C	: 60
Time, min	: 5,10,15,20,25,30,40
Solid liquid ratio, g/mL:	1:20
Temperature, °C	: 60

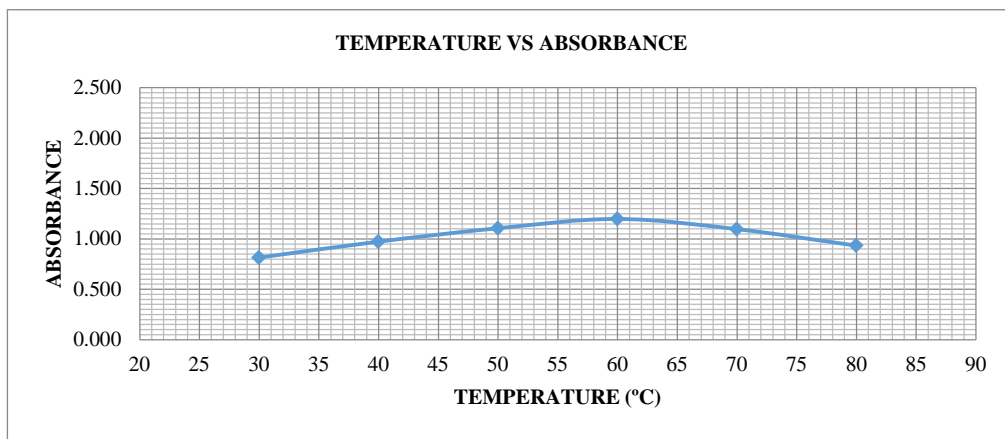


Figure 1 Effect of temperature on extraction of *Clitoria Ternatea* flowers

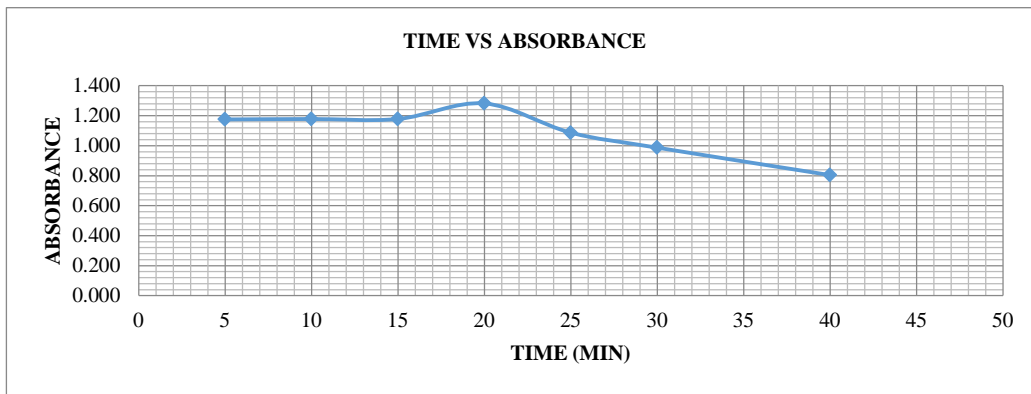


Figure 2 Effect of time on extraction of *Clitoria Ternatea* flowers

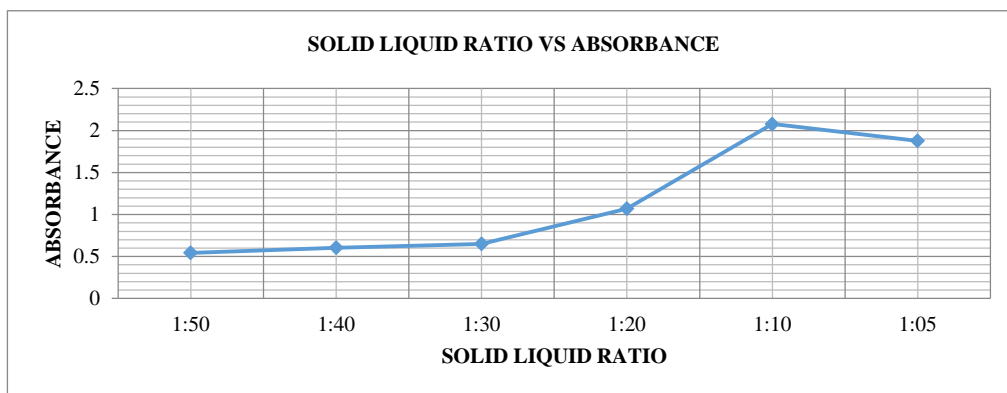


Figure 3 Effect of solid liquid ratio on extraction of *Clitoria Ternatea* flowers

4. CONCLUSION

The purpose of this study is to determine the optimum conditions for extraction of natural dye which extracted from *Clitoria Ternatea* flowers and explained the utilization of *Clitoria Ternatea* flowers for successful extraction of blue natural pigment which is delphinidine. The extraction of natural dye from *Clitoria Ternatea* flowers was optimized. Solid liquid ratio and time of extraction play an important role to increase the efficiency of delphinidine extraction at higher levels. Moreover, the experimental results revealed that the extraction of delphinidine highly favoured low temperatures rather than elevated levels. The optimum conditions for extraction natural dye from *Clitoria Ternatea* flowers were found to be extraction time: 20 minutes, temperature at 60 °C and solid liquid ratio: 1:10.

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