UNIVERSITI TEKNOLOGI MARA

OPTIMIZATION OF THE ULTRASONIC PARAMETERS OF EXTRACTION AND DYEING AND PRESERVATION OF NATURAL DYE FROM *XYLOCARPUS MOLUCCENSIS*

NORUL AZILAH ABDUL RAHMAN

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ABSTRACT

Traditionally, natural dyes were extracted by soaking or boiling method which requires long extraction time, high temperature and plenty of water. Hence, there is a demand to exploit suitable efficient techniques to extract natural dyes from plant materials. In this study, ultrasonic method was employed to extract natural dyes from a mixture of heartwood and bark of *Xylocarpus moluccensis* (XM) which can be found in mangroves forest around Peninsular Malaysia. An attempt has been made to optimize different extraction parameters such as solvent medium, concentration of NaOH, ratio of sample, ultrasonic volume (low, medium and high) and extraction time (ranged from 20 to 100 minutes). Extraction of 1:7 g ratio of heartwood to bark of XM using 0.1 M of NaOH, at medium ultrasonic volume and 80 minutes extraction time produced highest extraction yield of 54.22%. The extracted dye that contains tannin, lignin and mineral was then used for dyeing silk fabrics. Each of dyed fabrics was analysed to determine its color and fastness properties. Tonality of color (h^o) attained on silk fabric varied from 42.06^o to 51.70^o which attributes to brownish color while the intensity of color (C*) varied from 23.13 to 26.99. Based on color fastness test, silk fabric dyed at optimum dyeing condition of medium ultrasonic volume and 80 minutes of dyeing time shows the best fastness properties towards washing and perspiration. Extracted dyes used for dyeing are incapable to be stored for a substantial period of time due to their unstable property in liquid form. Therefore, this study also explores a suitable method to preserve the extracts for storage and produce natural dyes with longer shelf life for textile dyers. PVA-alginate was used as a pure/blank bead to encapsulate the colorant from *Xylocarpus moluccensis* using ultrasonic cleaner approach at different ultrasonic volume and time. Encapsulation at high ultrasonic volume in 80 minutes time produced highest encapsulation efficiency of 98% and adsorption capacity of 386 mg/g. Characterization using fourier-transform infrared spectrosopic (FTIR), scanning electron microscope (SEM) and x-ray diffraction (XRD) indicates the colorant was successfully encapsulated into the PVA-alginate beads. Dye released from PVA-alginate beads was applied to fabric to determine the dyeing ability of the encapsulated dyes. Intensity of color (C*) on the dyed fabrics was ranged within 13.54 to 26.99 and tonality of color (h^o) value was ranged within 49.58 to 60.92 that indicates brownish color. Fastness properties towards washing and perspiration for dyed fabrics using encapsulated dyes are considered good and comparable with those using crude dyes. Encapsulated dyes are proven to have enhanced stabilities towards light at low temperature of 4^{o}C.

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