

ANTIBACTERIAL ACTIVITY BY *KAEMPFERIA PARVIFLORA* MICROENCAPSULATION AND APPLICATIONS FOR TEXTILE INDUSTRY

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Abstract: This research was investigated in the efficiency of anti-bacteria by using *Kaempferia Parviflora*. The results found that *Kaempferia Parviflora* can be anti-bacteria in *Staphylococcus aureus* type. The mean of clear zone inhibition was 0.41 centimeter. The process of microencapsulate produce was also studied, the result of which showed the size 10 – 150 µm.

Key Words: *Kaempferia Parviflora*, Antibacteria Activity, Microencapsulate, Polylactic acid, Textile Technology

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1. Introduction

Herbal medicine is deeply rooted in Thai culture and continues to be strength of the country, which receiving widespread attention. Because of the nature of health care which is believed to be safe for the treatment of patients that require long-term drug treatment. In many researches were studies to develop medicines and herbal health products. That is the way to support the treatment of self-reliance. At present Thai herbs are wildly used in medical research and medicine because it has less cause side effects and low cost. Grosvenor, Supriono and Gray(1995) were studied by the 121 species of plants on the island of Sumatra. Indonesia was tested for activity against bacteria and fungi. The *Kaempferia parviflora* included for the study were antibacterial activity [1]. And it has proved of use in the treatment of other skin diseases [2]. In the one of the study were to investigate antibacterial activity of ethanol for the extraction of oil from *Kaempferia parviflora* by dish diffusion method. The result showed that have antibacterial activity against *Staphylococcus aureus*, *Streptococcus mutans*, *Escherichia coli* and *Candida albicans*[3]. The aim of this study was to study method for extraction and antibacterial activity (*Staphylococcus aureus* and *Klebsiella pneumoniae*) of *Kaempferia parviflora*. And prepare microcapsules containing *Kaempferia parviflora* oil were prepared by emulsion polymerization and applied to textiles in order to study the antibacterial activity and repellent efficacy of the obtained fabrics. To use clinical information about how to extract and extract *Kaempferia parviflora* oil effective in inhibiting bacteria and support the use of Thai herbs.

2. Materials and Experimental Procedures

Materials: *Kaempferia parviflora*(KP), which commonly referred to Thai name, Kra-Chai-Dum, belongs to Family Zingiberaceae form Phetchabun Province. Methanol was supplied by VWR International Ltd., (England). Poly-L-lactic acid (PLLA) and Polyvinyl alcohol (PVA) were supplied by Sigma-Aldrich, Inc. DCM (Dichloromethane) was supplied by P&N Labchem Ltd., PARA com. Binder PD-87 was supplied by Radchada Chemical Co., Ltd.

Preparation of KPoil: Essential oils of *Kaempferia parviflora* (KPO) are extracted by Hydrodistillation System (the plant material is in direct contact with boiling water in a crude metallic distillation outfit). KPO was prepared with the distillation of 250 kg of KP in a crude metallic distillation at temperature below 100°C for 6 hrs. Antibacterial activities of treated fabrics were evaluated by qualitative disc diffusion method [4]. The bacteria used was *Staphylococcus aureus* (ATCC 6538) (Gram positive) and *Klebsiella pneumonia* (ATCC 4352) (Gram negative). The statistics used in data of antibacterial activities analyzed by One-Way ANOVA.

Preparation of KPO encapsulates: The KPO was encapsulated in PLLA using the emulsion technique at room temperature. The KPO of 1.3 g. was first poured into the polymer solution (3.9 g. of PLLA dissolved in 50 ml. PVA) to form a water/oil emulsion. After that, the DCM was slowly added and mechanically stirred for 5 minutes at 5,000 rpm. Figure.1 shows the schematic diagram of the experimental process was slowly added and stirred gently to evaporate the organic solvent, resulting in the formation of KPO encapsulate. This microspheres were then separated by centrifugation, and dried under vacuum. The prepared capsules were analyzed by using optical microscope (UC1320, UPIX CAMERA).

Finishing of KPO microcapsules on textile substrate by Padding: KPO microcapsule was directly applied on 100% Cotton, 100% Polyester and 100% Nylon fabric by pad-dry-cure method with 2 concentrates were 10 g/l. and 20 g/l. respectively. 10 g/l. of PD-87 was used to binder for padding. Padding was carried out in a pneumatic padding mangle at a pressure of 2 psi. to get a pickup of 100% on weight of fabric. Drying and curing were carried out in spooner at 100°C for 1 min. and 120°C for 30 second respectively. The prepared textile substrate was analyzed by Scanning Electron Microscope, SEM (JSM-5610LV, JEOL).

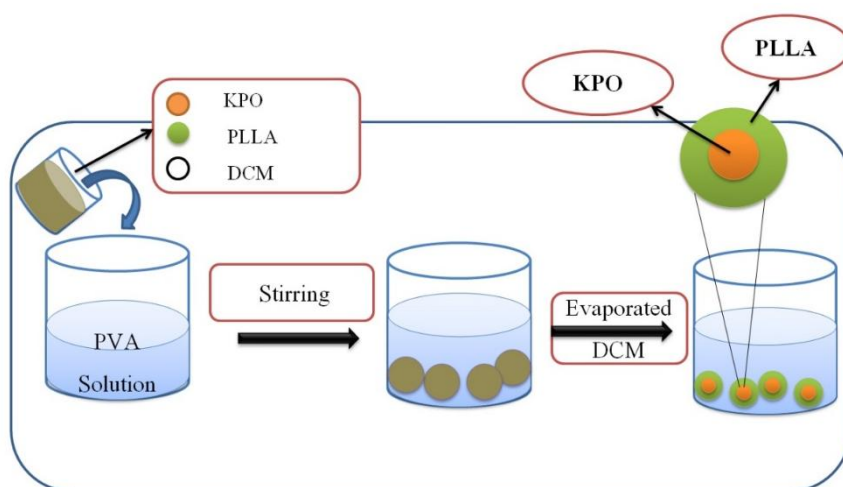


Figure. 1 Schematic of preparation the KPO microencapsulate

3. Results and Discussions

The yield of *Kaempferia parviflora* (KP) from Hydrodistillation process was found to be 5 ml. of KPO/250 kg. of KP.

The antibacterial properties of KPO can be studied by qualitative (*Staphylococcus aureus* and *Klebsiella pneumoniae*, respectively) test methods. This obtained from the culture collection of the Department of Sciences and Technology. The results of the disk diffusion test indicated that essential extracts of KP showed different degrees of growth inhibition, depending on the bacterial strains (Table 1). Results were statistically analyzed using One-Way ANOVA. There was a statistically significant difference in the antibacterial efficiency between all the groups between two bacterial strains **Table 1-2**.

Table 1: Antibacterial activity of essential extracts of KPO. The initial bacterial concentration in the incubates was 10^6 colony-forming units per ml. (CFU/ml).

Number Plate	<i>Staphylococcus aureus</i> (ATCC 6538)			<i>Klebsiella pneumoniae</i> (ATCC 4352)		
	Disk Diffusion Test (cm.)			Disk Diffusion Test (cm.)		
Plate 1	0.5	0.6	0.7	0.4	0.3	0.1
Plate 2	0.7	0.5	0.6	0.2	0.2	0.2
Plate 3	1.0	1.0	0.5	0.2	0.2	0.1

Table 2: Antibacterial activity of essential extracts of KPO analyzed by One-Way ANOVA.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.980	1	.980	40.786	.000
Within Groups	.384	16	.024		
Total	1.364	17			

The effect of KPO on different bacteria activities is showed in Table 2. Analysis of variance showed significant between *Staphylococcus aureus* and *Klebsiella pneumoniae* at $p < 0.05$.

Figure.2 showed KPO encapsulate from optical microscope were analyzed particle size by Image J version 11. KPO microcapsules showed regular spherical shape. Microcapsules in the 10 – 150 μm size range were obtained. The particles size average 23.881 μm , SD = 2.801. However, the size and degree of sphericity of the microcapsules depend on the stirring speed employed in the encapsulation [5] which reducing the stirring speed increases the size of microcapsules.

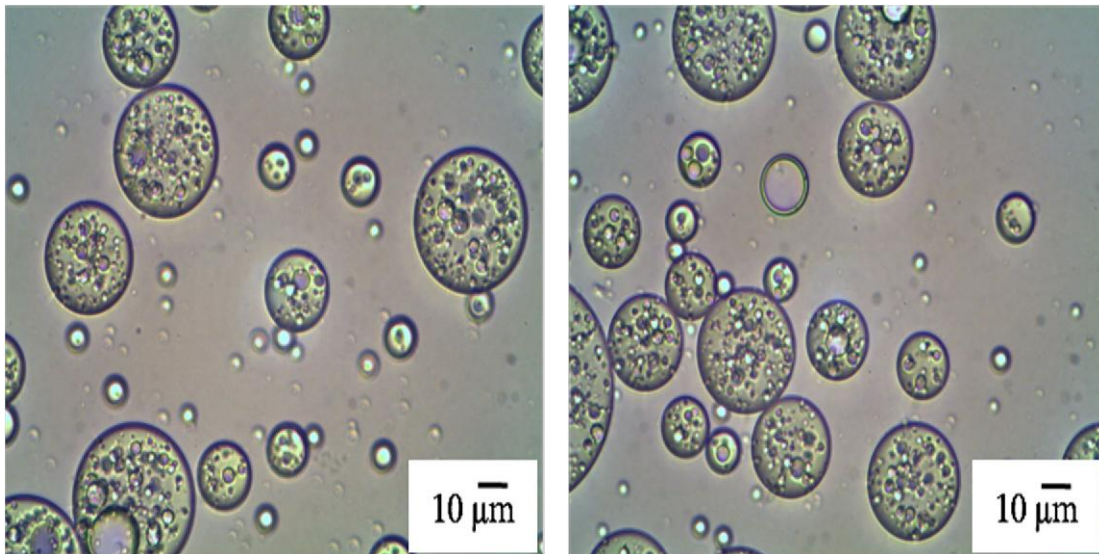


Figure. 2 Optical microscope images with magnification by 40X.

In this study, microcapsules were applied on textile by padding. For these methods, a binder is PD-87 (poly acrylic). Its role is to fix the microcapsules on fabric and to hold them on fabric 100% Cotton, 100% Polyester and 100% Nylon. The SEM images (Figure. 3) shows that the KPO encapsulate have three-dimensional structures on fabrics and connect together with good interconnection between the either surface The KPO encapsulate size ranged from 10 - 150 µm.

The SEM images (Figure. 3) shows that the morphology of KPO encapsulates compare between fabric 100% Cotton, 100% Polyester and 100% Nylon. In the picture shows 100% Nylon have KPO encapsulates more than 100% Cotton and 100% Polyester respectively. And compare between all most fabric Nylon show the most orderly arrangement.

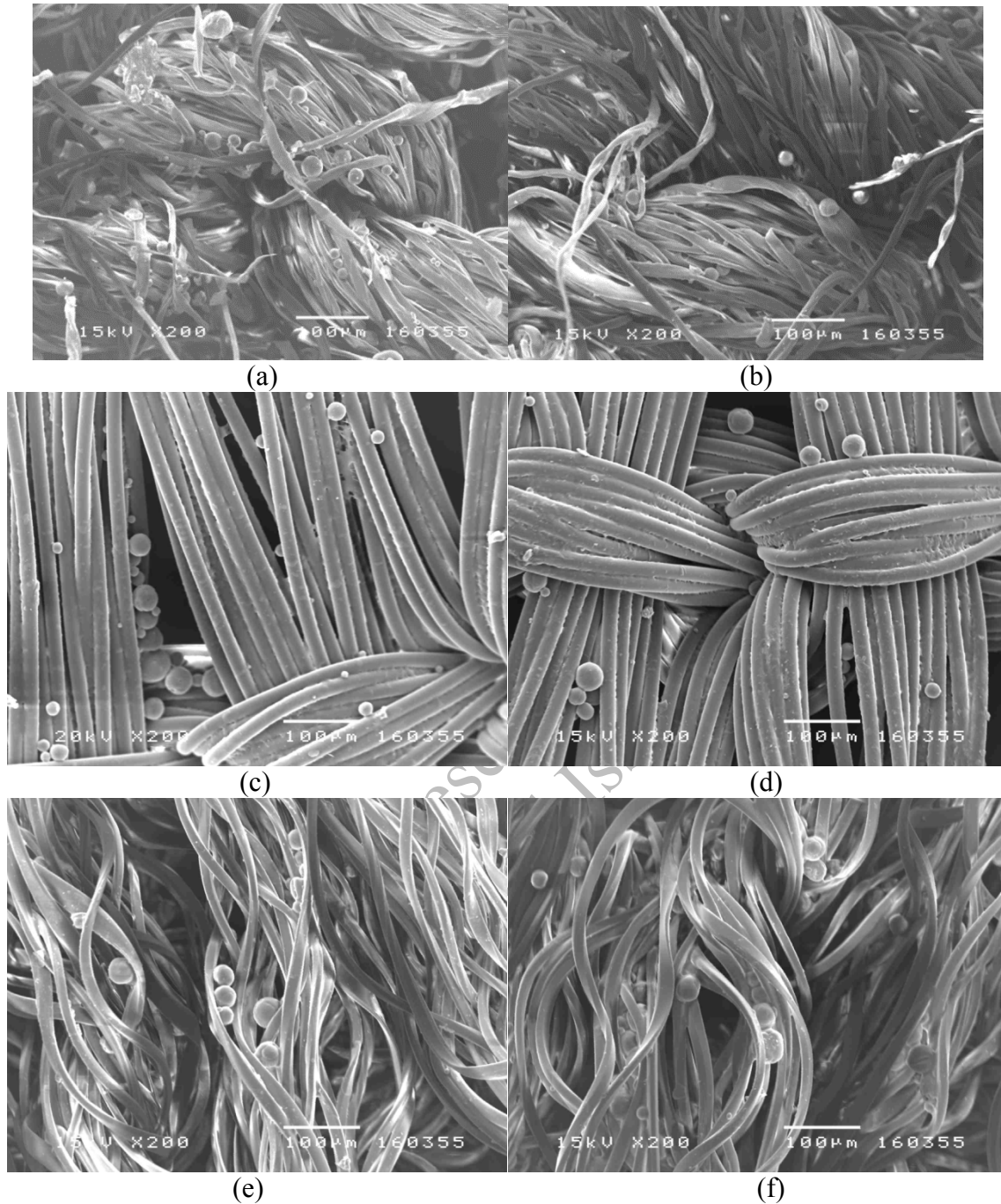


Figure. 3The SEM images with magnification by 200X.

- (a) 100% Cotton treat with KPO encapsulate 10 g/l. and binder PD-87 10 g/l.
- (b) 100% Cotton treat with KPO encapsulate 20 g/l. and binder PD-87 10 g/l.
- (c) 100% Nylon treat with KPO encapsulate 10 g/l. and binder PD-87 10 g/l.
- (d) 100% Nylon treat with KPO encapsulate 20 g/l. and binder PD-87 10 g/l.
- (e) 100% Polyester treat with KPO encapsulate 10 g/l. and binder PD-87 10 g/l.
- (f) 100 %Polyester treat with KPO encapsulate 20 g/l. and binder PD-87 10 g/l.

4. Conclusions

In this study, KPO microencapsulate was successfully prepared by emulsion polymerization. Moreover, it should be noted that the as prepared KPO microencapsulate are three-dimensional sphere that can see by optical microscope. Microcapsules in the 10 – 150 μm size range were obtained. The particles size average 23.881 μm , SD = 2.801. The effect of KPO on different bacteria activities showed significant between *Staphylococcus aureus* (ATCC 6538) and *Klebsiella pneumoniae* (ATCC 4352) at $p < 0.05$. KPO microencapsulate was adhesion on fabric substrate (100% Cotton, 100% Polyester and 100% Nylon) completely.

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