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Identification of Patchouli-Oil Physical Properties on Oil Purification by Using Acid-Activated Bentonite

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***Abstract*— This research is aimed at obtaining patchouli-oil physical properties on purification that include clearness, specific gravity, refractive index and optical rotation. The method of research used is Complete Randomized Design (CRD) with factorial design. Two factors that have been examined are 1) bentonite activations with 3 levels: inactivated bentonite, H2SO4-activated bentonite, and HCl-activated bentonite; and 2) the number of bentonite applications with 5 levels: 1%, 2%, 3%, 4% and 5%. An analysis of oil color is made by using UV spectrophotometer to see clearness or its transmittance percentage. The results of experiment indicate that percentage of transmittance increases from 69% to 70.80 – 81.55%; specific gravity and optical rotation are in accordance with Indonesian National Standard (SNI 06-2385-2006); and refractive index is 0.0044 – 0.0086 points above the standard. The H2SO4-activated bentonite with 2% application is the best outcome. This is shown with the highest clearness and transmittance percentage of 81.55%, specific gravity of 0.9284, refractive index of 1.5186 and optical rotation of (-) 49oC.**

***Keywords*— bentonite; patchouli oil; purification**

I. INTRODUCTION

Patchouli oil is one of popular commodities in oil trading world. It is extracted from distilling the leaves and trees of patchouli plants Poqostemon cablin Benth. This oil is known as a fragrant aroma fixative and prevents evaporation of fragrant gases in perfume.

In 2008, the whole area of patchouli plantation in West Sumatra, Indonesia, was 3,042 Ha concentrated on Pasaman Barat regency with 1,315 Ha in area, followed by Kepulauan Mentawai regency with 990 Ha in area.

In recent years, the patchouli oil produced by local farmers has very low grade, making the selling price relatively cheaper. The cause of low-grade quality is that the patchouli oil produced is still containing organic or inorganic colorants that makes the oil dark liquid. Therefore, it is necessary to develop an inexpensive means to eliminate colorants in patchouli oil for better quality.

Suarya having purified clove oil using 1.2-M H2SO4-activated bentonite, showed that the comparisons of absorbent weight (g) and clove-leave oil volume (ml) were 1:20, 1:40, 1:60, 2:80 and 1:100. His highest absorption outcome was 1:40, meaning that the usage of bentonite was ± 2.8% of oil weight [1].

II. METHOD OF RESEARCH

A. Materials and Instruments

The raw materials used are patchouli oil extracted from farmers' purification in Rimbo Binuang village, Lingkung Aur District, Simpang Ampek, Pasaman Barat regency.

The chemicals applied for activations of bentonites are bentonite (Al2O3.4SiO2 2H2O); H2SO4 1.2 M, HCL 1.3 M. The chemicals needed for analysis of physical properties in patchouli oil are etanol, dietyl ether, and distilled water.

The instruments used are a flask, two 140-mesh sieves, 100-ml measuring glass, magnetic agitator, screen, porcelain scraper, 230-mesh sieve, water-cash and analytical scales, N-200-typ magnesium monel cloth, UV spectrovotometer, water heater conversed at 250C ± 0.20C, 5-ml capacitated picnometer in accordance with available oil volume, furnished with calibrated thermometer, refractometer, and polarimeter.

The experiment was conducted in two stages. The first stage was the activations of bentonites and the second was the purification of patchouli oil. The former was carried out under the guidance of the experiment [1]. It was adjusted for the following treatments: inactivated bentonite was sieved by 140-mesh sieve, drawn 300 g and poured into a 2-L flask, and added with 1.2 M H2SO4/HCl at the quantity of 1200 ml (the comparison of 1:4 [1]), agitated by magnetic agitator, activated during 24 hours, screened until it was free

of H2SO4/HCl and washed with hot water for perfect detachment of H2SO4 and HCl to reach pH 7, dried up within an oven at temperature 1000C for 1 hour, and scraped by porcelain scraper.

The purification of patchouli oil in this research was under the guidance of clove-oil purification with the following steps: the patchouli oil of farmer-made purification at the quantity of 200 g was mixed with bentonite in accordance with the treatments of applying shaker bath for 5 hours, deposited for 24 hours, and this oil was separated from bentonite using a centrifuge for 15 minutes, and screened by N-200-type monel cloth[2].

B. Analysis of Data

The Complete Randomized Design (CRD) in factorial was applied. Factor 1 was the activation of bentonites which was done with 2 levels as the followings: inactivated, H2SO4-activated, and HCl-activated. Factor 2 was the application of bentonites with 5 levels: 1%, 2%, 3%, 4% and 5%. Each treatment was repeated twice.

III. Result and Discussion

A. Observation Before Purification

The observation before purification can be seen in Table 1.

TABLE I
THE RESULTS OF PATCHOULI-OIL ANALYSIS BEFORE PURIFICATION AND GRADING REQUIREMENTS OF SNI 06-2385-2006

No.	Types of Tests	Unit	Before Purification	Requirements
1.	Clearness	%	69	-
2.	(transmittance %)	-	0.965	0.950-0.975
3.	Specific gravity	-	1.522	1.507-1.515
4.	Refractive index	-	(-) 51^0	(-)48^0 - (-)51^0C
	Optical rotation			

Of the items observed, generally they all have been conforming to SNI 06-2385-2006.

B. Observations after Purification

1) Clearness (Transmittance Percentage):

From the Fig 1, it can be seen that the bentonite activations with acids provide higher transmittance percentage than those inactivated for all bentonite applications. The downside of such bentonites could be overcome by the process of activations with acids (HCl, H2SO4, and HNO3) to produce the bentonites with higher absorption ability [3].

2) Specific Gravity

From the Fig 2, it can be noted that the specific gravities of patchouli oil with H2SO4-acitvated and HCl-activated bentonites are lower after purification. This is because the impureness and metal oxides available in the oil have been absorbed by bentonites.

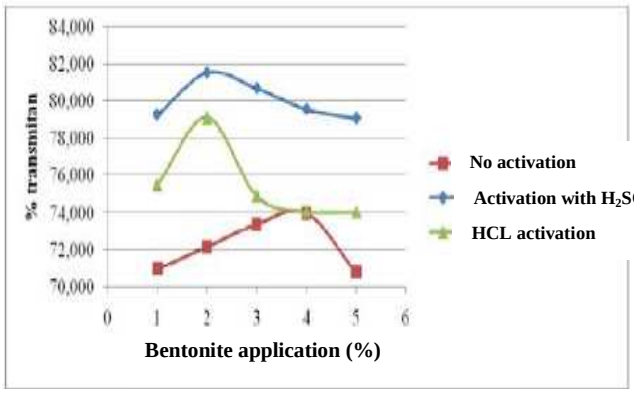

Fig. 1 The graph of relationship between bentonite activations and bentonite applications and transmittance % of patchouli oil after purification.

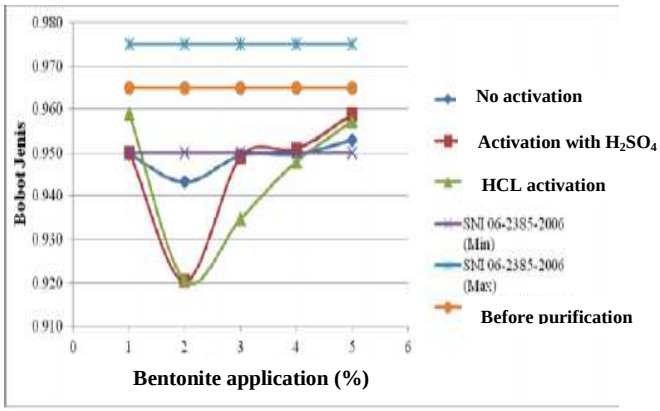

Fig 2. The graph of relationship between bentonite activations and bentonite applications and the specific gravities of patchouli oil after purification.

3) Refractive Index

Refractive index of the oil before purification is 1.522 which is higher than that of after purification. The drop of refractive index after purification is because of absorption of several oil components by absorbents that make the oil densities reduced. The variation of data obtained is also influenced by the combination of the activation levels and the number of bentonite applications. H2SO4 is the acid that easily absorbs metals and metal oxides and neutralizes base. Although SO4-2 is just a weak oxidative in diluted acid solution, the dense H2SO4 is a strong oxidative.

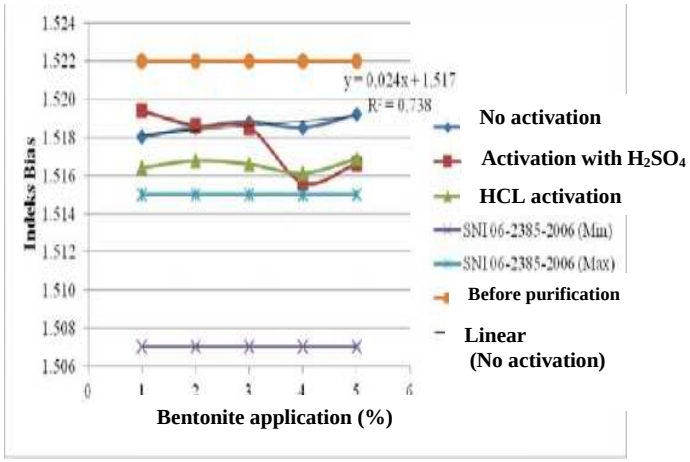

Fig 3. The graph of relationship between bentonite activations and bentonite applications and refractive indexes of patchouli oil after purification.

4) Optical Rotation:

From the Fig 4, it is seen that the inactivated bentonite provides the highest value in optical rotations for all bentonite applications. This is caused by a lack of inactivated bentonite absorptive ability. Bentonite is very useful for absorption; however, the ability of its absorption is limited. This weakness can be resolved by activation with acid [4].

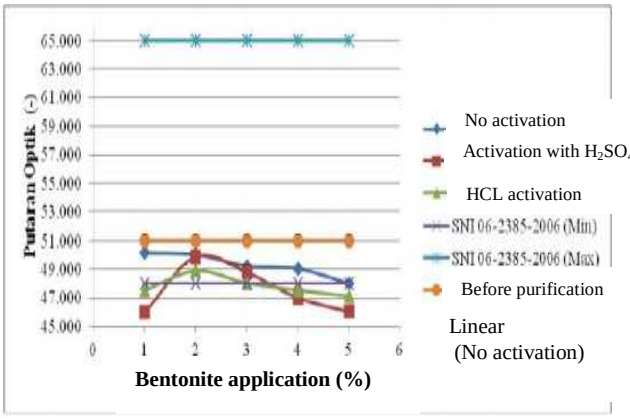

Fig 4. The graph of relationship between bentonite activations and bentonite applications and the optical rotations of patchouli oil after purification.

IV. Conclusions

The analysis of patchouli oil before purification provides the value of clearness or transmittance percentage of 69% and the other physical properties have been eligible to SNI 06-2385-2006, except for the value of refractive index that is 0.007 points higher than the standard.

The acid-activated bentonites increase the transmittance percentage from 69% to 70.80-81.55%. The specific gravity and optical rotation are generally eligible to the SNI. The refractive index is 0.0044-0.0086 higher than the standard.

H2SO4-activated bentonite with 2% bentonite application is the best outcome. This is shown with the high transmittance percentage of 81.55%, specific gravity of 0.9284, refractive index of 1.5186 and optical rotation of (-) 490C.

V. Suggestions

Further research is necessary to examine the acid concentration for bentonite activation and to know the contact time between bentonite and oil during the purification process.

The process of acid washing from bentonite following its activation should use high absorptive ability to absorb faster and more perfect acids.

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