Civil and Environmental Science Journal (CIVENSE)

journal homepage: https://civense.ub.ac.id/index.php/civense

Original research article

Fe ion extraction in patchouli oil with ion exchange using resin

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ARTICLEINFO

Keywords:
Patchouli oil
Ion Exchange
Resin

ABSTRACT

Patchouli is the largest non-oil export commodity among essential oil exports in Indonesia. However, the quality of patchouli oil in Indonesia is considered to be very low. Traditional patchouli oil distillation is carried out in a small capacity and uses a simple distillation method based on a large difference in boiling points or one of the volatile components. This process produces poor quality patchouli oil such as acid number more than 8, dark oil, patchouli alcohol less than 30%, and high water content. This is evidenced by the large amount of Fe metal contained in patchouli oil. Patchouli oil produced contains a lot of iron in its yield, so it needs further processing to reduce the Fe content in patchouli oil. The use of resin as an adsorbent for Fe metal is one way to reduce the Fe metal content. Resin weighing 50, 150 and 250 grams was added to 200 ml of patchouli oil. Then the stirring process was carried out with a stirring speed of 200 rpm with time variations of 30, 60 and 90 minutes. The results obtained showed the best adsorption process with Fe content in patchouli oil of 1.42 mg/Kg, contact time of 90 minutes and amount of resin of 250 grams with the largest percentage of removal of 87.5%.

1. Introduction

Patchouli oil is an essential oil obtained by distilling the leaves of the patchouli plant (Pogostemon cablin Benth). Patchouli oil which belongs to essential oils is an important component in the perfumery industry such as perfume, soap, deodorant, etc. Patchouli oil is the largest non-oil export commodity among essential oil exports in Indonesia. Since Indonesia is a supporter of the need for patchouli oil, it is not surprising that there are many patchouli oil industries throughout Indonesia, including Nanggroe Aceh Darussalam. In general, patchouli farmers in Nanggroe Aceh Darussalam still use tools made from used drums so that the patchouli oil produced contains a lot of iron in the yield, so a further process is needed to reduce the Fe content in patchouli oil [1].

Patchouli oil is an essential oil extracted from the leaves, stems and branches of the patchouli plant. Is one type of essential oil whose function cannot be replaced by synthetic substances in the soap, cosmetic and perfume industries because it plays a very important role in determining the strength, performance and durability of fragrances. This is because of its nature to combine the smells of other perfume ingredients (binding agents) and at the same time form a harmonious smell in the mixture [9]. Indonesia is the world's largest producer of patchouli oil, meeting 70% to 90% of world demand each year. Indonesia's patchouli oil export volume fluctuates around 6% annually, an annual increase from 700 tonnes to 2,000 tonnes of patchouli oil [10]. Among the types of patchouli in Indonesia, patchouli that is widely planted and widespread is Acehnese patchouli because it has higher oil content and the quality of the oil produced is higher than the others [11].

Traditional patchouli oil distillation is carried out in a small capacity and uses a simple distillation method based on a large difference in boiling points or one of the volatile components. This process produces poor quality patchouli oil such as an acid number of more than 8, dark oil, less than 30% patchouli alcohol, and high water content [2].

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Doi: 10.21776/ub.civense.2023.00601.2
Received 21 November 2022; Accepted 7 March 2023
E-ISSN: 2620-6218/

Civil and Environmental Science Journal
Vol. 06, No. 01, pp. 011-014, 2023

Based on previous researchers researched by Mulyana Surya Ningsih (2020) entitled "Reduction of Metal Iron (Fe) in Patchouli Oil, (Patchouli oil) Using the Complexometric Method Using Ethylene Diamine Tetra Acetate (EDTA)" the conclusion was obtained in the form of variations in the concentration of chelating agents (EDTA) with a stirring time of 90 minutes had an effect on the color of the reduced patchouli oil. This is evidenced by the occurrence of color changes in patchouli oil after reduction, although not significant [3]. Furthermore, researchers by Nadia Kresentia Manalu, Dimas Presetyo, L. Urip Widodo (2019) entitled "Adsorption of Fe Metal in Patchouli Oil Using Chitosan on Fish Scales" Based on research that has been conducted chitosan isolated from fish scales can be used as an adsorbent of Fe metal in oil patchouli The best conditions were obtained at the amount of 5% chitosan and 90 minutes of contact time [1]. Then research by Pocut Nurul Alam (2007) with "Title Application of the Gelating Process for Improving the Quality of Aceh Patchouli Oil" concluded that Purification of patchouli oil using chelating compounds can reduce the Fe content in patchouli oil by 60% with a bright yellow color. Obtained the lowest content of patchouli oil that is equal to 0.9514 ppm [5].

Due to the high Fe content in patchouli oil, Fe ions were taken using the ion exchange method. According to Mulyati (2006) ion exchange is a process in which there is an exchange of similarly charged ions between solution and insoluble solids in solution. The ions from the electrolyte solution are bound to the surface of the solid material, but it is the ions from the solid material that are delivered into the solution [6]. Ion exchange itself can be done in various ways, one of which is by using Resin (Amberlit IRC-50).

2. Material and Methods

2.1 Research Tools and Materials

The tools used in this research are Stirred Tank, Glass Beaker, Analytical Balance, and Atomic Absorption Spectrophotometry (AAS) Method. While The materials used in this study were patchouli oil which was of low quality (did not meet SNI standards) and cation exchange resin.

2.2 Research Methods and Steps

Analyze the Fe ion levels in Patchouli Oil using Atomic Absorption Spectometer (AAS). After knowing the level of Fe ions in patchouli oil, weigh the resin using an analytical balance of 50 grams, 150 grams, 250 grams and pour the resin into the Beaker Glass. Pour the Patchouli Oil whose Fe content is known with a Volume of 200ml into a Glass Beaker that has been filled with resin. After the Resin and Patchouli Oil were mixed in the Glass Beaker, place the glass beaker in a stirred tank with 200 (rpm) stirring for 30 minutes, 60 minutes, and 90 minutes. Re-analyze the Fe ion levels in Patchouli Oil using the Atomic Absorption Spectometer (AAS).

3. Result and Discussion

Based on the results of the analysis it is known that the Fe content in patchouli oil is 11.36 mg/L, in 200 ml of Patchouli Oil the weight of Fe is 2.272 mg.

Table 1
Effect of the amount of resin and contact time of resin with patchouli oil on remaining Fe Content in Patchouli Oil.

Amount Of Resin (gr)	Time (Minute)	Remaining Fe Content In Patchouli Oil (mg/L)	Percent Exchanged Fe (%)
50	30	4.42	61.09
	60	3.82	66.37
	90	4.01	64.7
150	30	3.75	66.9
	60	3.13	72.44
	90	3.19	71.91
250	30	2.67	76.49
	60	1.76	84.5
	90	1.42	87.5

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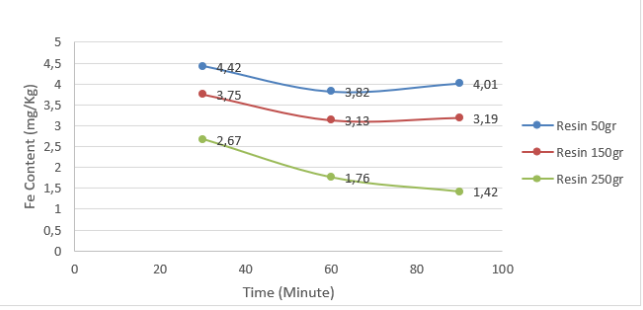

Fig. 1. The effect of time on the decrease in levels of Fe Metal.

Determination of the effect of contact time aims to find the optimum time of the Fe metal adsorption process on patchouli oil using a resin adsorbent. The effect of the length of the contact time was carried out by the continuous method on variations in contact time of 30, 60 and 90 minutes on 50gr, 150gr, and 250gr of resin with the initial Fe content in patchouli oil of 11.36 mg/kg.

This was theoretically stated by Irawan (2015) where the decrease in the percentage of adsorbed Fe2+ ions decreased because the adsorbed adsorbate would crowd on the surface of the adsorbent causing the active surface area of the adsorbent to shrink so that it was unable to adsorb Fe ions again and Fe ions that had been adsorbed or that had been adsorbed or that had been adsorbed will be desorbed back into the solution [7].

This was also reinforced by Pitriani (2010) who stated that there was a decrease in the percentage of adsorption because the amine and hydroxyl groups present in the resin were fully bound to other components besides H+ or were already saturated. If the adsorption condition is too long, it is possible that the bound metal ions will be released again or desorption will occur [8]. And according to Firdiyono (2012) another possibility is that the relatively long adsorption process causes the adsorbent pores to shrink [8].

As for the effect of the amount of resin on the reduction of metal content of Fe. Determination of the effect of the amount of resin aims to find the optimum amount of resin from the adsorption process of Fe metal on patchouli oil by using a resin adsorbent. The effect of the amount of resin is carried out by the continuous method on variations in the amount of resin 50gr, 150gr, and 250gr in 200ml patchouli oil with the initial Fe content in patchouli oil of 11.36 mg/kg.

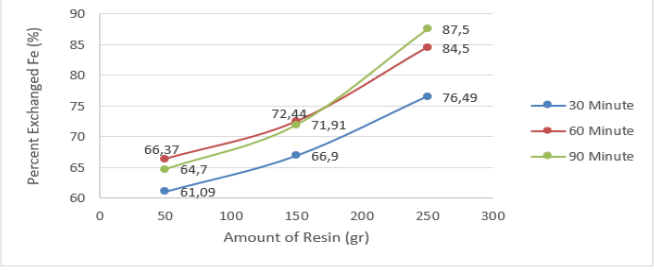

Fig. 2. Effect Of Resin Amount on the Percentage of Fe Exchange.

Determination of the effect of the amount of resin aims to find the optimum amount of adsorbent from the Fe metal adsorption process on patchouli oil using resin adsorbent. The effect of the large amount of resin was carried out by the continuous method on variations in the amount of resin of 50gr, 150gr, and 250 gr in 200ml of patchouli oil with the initial Fe content in patchouli oil of 11.36 mg/kg.

This means that the more adsorbents added, the more Fe metal ions are adsorbed due to the more active groups that can absorb Fe2+ metal ions so that the Fe content in patchouli oil will gradually decrease. This is in accordance with Langmuir's adsorption theory which states that the surface of the adsorbent has a certain number of adsorption active sites. The number of active sites is proportional to the surface area of the adsorbent and each active site can only adsorb one adsorbate molecule. In a situation where the adsorption site is not saturated with the adsorbate, the increase in the adsorbate concentration will increase the amount of the adsorbed substance.

The best conditions were obtained for the amount of resin as much as 250 g at 90 minutes with the amount of Fe content contained in patchouli oil being less, namely 1.42 mg/Kg or with an absorption capacity of 87.5%. The optimum conditions are not yet known because according to graph IV.2.2 above, the amount of 250gr resin is still not saturated or there is still Fe metal in patchouli oil. Most likely the resin will still be able to adsorb Fe metal in the amount of resin above 250gr.

4. Conclusions

In this study it can be concluded that for reducing the Fe content of Patchouli Oil it is suitable to use the resin used, the best level that can be taken is with a contact time of 90 minutes and the amount of resin is 250 gr with the largest percentage of removal, which is 87.5%. The best Fe ion content in Patchouli Oil was obtained at a level of 1.42 mg/Kg, this indicated that the Fe ion content in Patchouli Oil met the Indonesian National Standard (SNI), where the Indonesian National Standard (SNI) for patchouli oil is a maximum of 25 mg /Kg.

Acknowledgements

The authors would like to express the deepest gratitude to the assistant team of the Chemical Engineering Laboratory, UPN "Veteran" Jawa Timur for their support in the simulation and experimental works.

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