

STUDY ON NATURAL FLOOR CLEANER FROM SOME HERBALS

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Abstract: The study presents synthesizing natural floor cleaner from soapberry, essential oil of cinnamon, coriander, and lemongrass. Different composite ratios are given and surveyed through user opinions to determine the optimal ratio. The natural floor cleaner product achieves the criteria of being clean, antiseptic, non-sticky, and slight scent at the optimal rate of 1L of floor cleaning solution, including 300ml of soapberry: 300ml of cinnamon: 380ml of distilled water: 10ml glycerol: 5ml coriander essential oil: 5ml lemongrass essential oil. The optimal floor cleaning sample was analyzed according to TCVN 12589:2018- Floor cleaner – technical requirements and test methods.

Keywords: floor cleaner, soapberry, cinnamon, coriander, lemongrass.

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1. INTRODUCTION

Today, chemical floor cleaners are popular, with ingredients from chemical compounds, with many advantages, such as the ability to clean and disinfect quickly and cleanly [1-4]. In addition, it has a long-lasting scent and good preservation ability. However, according to many studies, using chemical floor cleaners for a long time can affect humans, for example, causing allergies, skin irritation (especially for children), breathing problems, some liver and lung diseases, and potential cancer risk. Moreover, the wastewater after using these floor cleaners can affect the water environment and the wastewater system. Many herbs have cleansing, antiseptic and scenting properties [5], but the following have outstanding properties such as:

Soapberry: Soapberry contains *Sapindus saponin* ($C_{41}H_{61}O_{13}$) which has strong cleansing power. So, soapberry is often used to make some detergents such as washing clothes, washing dishes, cleaning floors, washing hair...

Cinnamon: The most crucial ingredient in cinnamon is essential oil. The cinnamon essential oil contains no less than 85% cinnamic aldehyde and several other compounds, such as diterpenoids, phenyl glycosides, flavonoids, tannins, and coumarins. The cinnamon essential

oil has antiseptic effects, stimulates the nervous system and digestion, enhances blood circulation, and promotes intestinal peristalsis.

Coriander: The composition of coriander essential oil includes compounds such as borneol, cineole, cymene, dipentene, linalool, phellandrene, pinene, terpineol, and terpinolene, which have the effect of reducing stress, relaxing, reducing pain, eliminating unpleasant odors.

Lemongrass: Lemongrass essential oil has a fresh lemon scent mixed with lemongrass. Lemongrass essential oil contains 65-85% citral content, vitamins and minerals. It should have antibacterial and reduce headaches.

The research aims to create a user-friendly and environmentally friendly floor cleaning product; it has investigated the properties of some natural herbs such as soapberry, cinnamon, coriander, and lemongrass.

2. MATERIALS AND METHODS

2.1. Methods

2.2.1. Literature review

Overview of primary and secondary documents related to:

- Chemical floor cleaner, organic/natural floor cleaner.
- Natural herbs with cleansing, antiseptic, and fragrance properties
- Some processes for synthesizing organic floor cleaners
- Characteristics and properties of soapnut extract, cinnamon essential oil, lemongrass essential oil, coriander essential oil

2.2.2. Experiments: pre-treatment material

- Soapberry:

- Soapberry has a high Saponin content, about 52-60% [6], completely soluble in water and without impurities, was imported for research use.

- Soapberry will then experiment to determine the dilution ratio with distilled water with the following criteria: the foaming level after shaking is moderate; the stone and wood floor must be clean, no residue, no stickiness. All criteria will be determined by sense.

- Soapberry dilutes with the following ratio of water/soapnut extract: 1:100; 1:200; 1:300; 1:400; 1:500.

Based on the use and visual evaluation results after testing (mentioned in section 3), it is determined the optimal high-dilution ratio of soapnut and water.

- Cinnamon essential oil:

- Cinnamon bark is washed and then boiled in water at a temperature of 100°C, high pressure for 5 hours. Then cool and filter, and a cinnamon essential oil solution is obtained [6,7].

- Cinnamon essential oil does not need pretreatment but is used in experiments.

- Lemongrass and coriander essential oil

- Preparation of essential oils by direct distillation method.

2.2.3. *Synthetic natural floor cleaning solution*

Two main components determine natural floor cleaner: The solution has cleaning and disinfecting properties: diluted soapberry solution and cinnamon essential oil.

Fragrance part: Includes lemongrass and coriander essential oil

For solutions with cleaning and disinfecting properties: two solutions from soapberry and cinnamon essential oil in the ratio of volume: 1:1; 1:2; 2:1; and 1:3. Based on sensory evaluation and opinion of the research team, the optimal ratio will be proposed. After having the optimal ratio of soapberry and cinnamon essential oil solution, the research team further diluted it with distilled water at the ratios 1:0.5; 1:1; 1:1.3; 1:1.5, and 1:2. When finding the optimal ratio will add lemongrass essential oil and coriander to create aroma. The organic floor cleaner was tested at the ratios of soap : cinnamon : distilled water : lemongrass essential oil : coriander essential oil as follows 30:30:38:1:0; 30:30:38:0:1; 30:30:38:1:1; 30:30:38:1:2; 30:30:38:2:1 and 30:30:38:2:2. On that basis, the organic cleaning solution has been determined the optimal ratio through laboratory experiments. However, because many senses express the results, the authors made a questionnaire to survey users.

2.2.4. *Questionnaire*

- Number of survey questionnaire: 15
- Floor cleaner at the ratio 30:30:38:1:0; 30:30:38:0:1; 30:30:38:1:1; 30:30:38:1:2; 30:30:38:2:1 and 30:30:38:2:2 are denoted as A, B, C, D, E and F, respectively.
- The survey form has the following contents:

I. Sensory evaluation of cleaning effect, repelling insects and scent

- Foam level when mixing 100ml of solution with 5L of water? (*Less – Moderate – Many – Other*)
- Is the surface of the material clean after wiping? (*Yes- Not - Other*)
- Is there any stickiness or grit after cleaning? Use hand to feel (*Sticky - Nonsticky - Other*)
- Is the scent pleasant? is it hot? (*Comfortable 1- Comfortable 2 - Comfortable 3- Uncomfortable - Other, where 1 to 3 represents an increasing degree of comfortable*)
- Does the scent last long? (*15 minutes - 30 minutes - 1 hour - 2 hours - 3 hours*)

II. Changes in use over time

- Under good storage conditions, does the scent decrease? (*Reduce a lot - Reduce a little - No reduction - Other*)
- Does the bottom of the bottle see sediment? (*Many – Less – None – Other*)

III. Impact on user's health

- Does it cause skin irritation? (*Yes – No – Other*)
- Children have irritation, rash? (*Yes – No – Other*)

- Have breathing problems (within 1 week of use) (*Yes – No - Other*)

2.2.5. Sampling analysis

The floor cleaning sample is shaken well, bottled 1L, sent for analysis at the Technical Center for Standards and Quality 1 (Quatest1), according to TCVN 12589:2018

3. RESULTS AND DISCUSSION

3.1. Composition and properties of natural floor cleaner

3.1.1. Dilution ratio of soapberry and cinnamon essential oil

Soapberry was diluted with distilled water in different proportions and the results shown in Table 1.

Table 1. Dilution ratio

Ratio	1:100	1: 200	1:300	1:400	1:500
Foam level	Many	Many	Moderate	Less	Less
Stone and wood surface after wiping	Clean, stickiness and sticky marks	Clean, a little stickiness	Clean and dry	Clean and dry	Clean and dry
Colour	Dark brown	Dark brown	Pale brown	Pale brown	Pale brown

In Table 1, it can be seen that when increasing the dilution between soapberry and distilled water, the foaming level decreases, specifically at 1:100 and 1:200 samples give much foam level, while at 1:400 and 1:500, there is little foam. Therefore, with the criterion of moderate foam, the 1:300 sample rate is the most moderate. In addition, the 1:300 sample gives better cleanliness, dryness, and color than the rest. Therefore, a dilution ratio of 1:300 was chosen for the subsequent experiments.

3.1.2. Natural floor cleaner ingredients

Cleaning and disinfecting ingredients

From the following table, it shows that the cleaning effect at the ratio 1:1 and 2:1 gives good effect, however, the foaming ratio at the ratio 2:1 is high, so the 1:1 ratio was chosen for the next experiments.

Table 2. Effective ratio of soapberry and cinnamon solution

Ratio (soapberry/cinnamon)	Colour	Cleaning ability	Foam level	Smell
1:1	Sepia	Good	Moderate	Light
1:2	Red brown	Weak	Less	Strong smell of cinnamon
1:3	Red	Weak	Less	Strong smell of cinnamon
2:1	Brown	Good	Many	Not clear

The cleaning efficiency of soapberry and cinnamon diluent is shown in the following table:

Table 3. Effective ratio of soapberry, cinnamon and water solution

Ratio (soapberry/cinnamon/water)	Colour	Cleaning ability	Foam level	Smell
1:0,5	Sepia	Good	Many	Light
1:1	Sepia	Good	Moderate	Light
1:1,3	Sepia	Good	Moderate	Light
1:1,5	Sepia	Moderate	Less	Light
1:2	Sepia	Moderate	Less	Less

After being diluted with distilled water at different rates, soapberry and cinnamon solutions retain their reddish-brown color. The cleaning efficiency is inversely proportional to the amount of distilled water, the more diluted, the lower the efficiency. The excellent effect is shown in the ratios 1:0.5, 1:1, and 1:1.3. The degree of foaming is also inversely proportional to the degree of dilution. At the ratio of 1:1 and 1:1.3 for medium and moderate foaming. In addition, at these two ratios, there is a slight odor. For economic optimization, the research team chose a 1:1.3 ratio of soap, cinnamon, and distilled water solutions for flavoring experiments in the following section.

Ingredients for cleaning, disinfecting and flavoring

The following table shows the effectiveness of organic floor cleaner at different ratios of lemongrass essential oil: coriander essential oil. It can be seen that only the smell of organic floor cleaners changes when adding flavoring ingredients. Only the aroma ratio sample is 30:30:38:1:1, the aroma is pleasant while the other samples show the strong smell of lemongrass or smell. With the given results, the research team found that the ratio of 30:30:38:1:1 achieved optimal efficiency in terms of cleaning, disinfecting and aromatherapy effects.

Table 4. Effective natural organic floor cleaner

Ratio	Colour	Cleaning ability	Foam level	Smell
30:30:38:1:0	Sepia	Good	Moderate	Strong smell of lemongrass
30:30:38:0:1	Sepia	Good	Moderate	Strong smell of coriander
30:30:38:1:1	Sepia	Good	Moderate	Pleasant
30:30:38:1:2	Sepia	Good	Moderate	Strong smell of coriander
30:30:38:2:1	Sepia	Good	Moderate	Strong smell of lemongrass
30:30:38:2:2	Sepia	Good	Moderate	Strong smell of lemongrass

3.2. User survey results

30 survey questionnaires were distributed and 15 questionnaires were collected. In which, 12 votes were for wooden floor (accounting for 40%) and 18 votes were for stone floor (accounting for 60%).

Sensory evaluation of cleaning effect, repelling insects and scent

The foaming when mixed with 100ml of solution with 5L of water of 6 test samples is shown in the following figure.

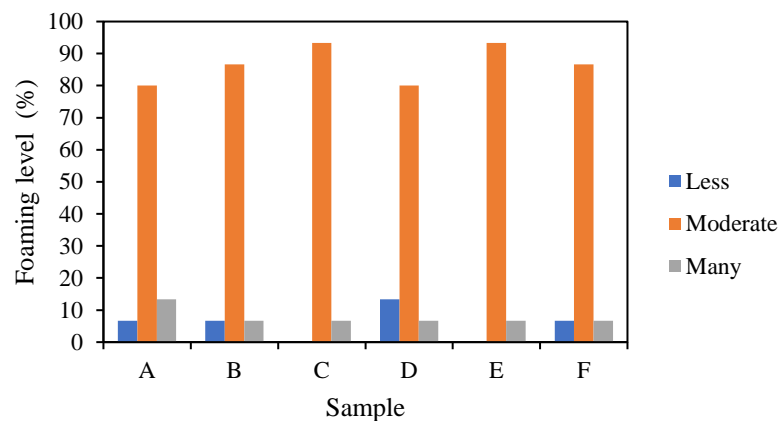


Figure 1. Foaming level of 6 samples

All six samples were assessed as having moderate foaming and accounted for more than 80% of the respondents, of which samples C and E had more than 90%.

Figure 2 shows the cleanliness and stickiness of the 15 rating sheets. 100% of the survey samples were rated as clean efficiency. 5/6 samples did not have a sticky or gritty feeling after wiping, while sample F had 1 vote for having a sticky feeling.

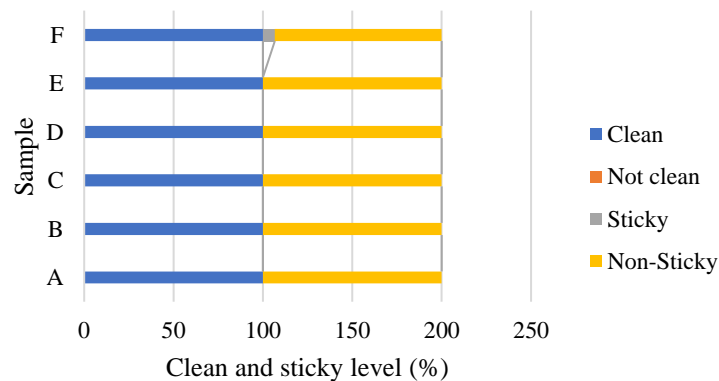


Figure 2. Degree of cleanliness and stickiness after wiping

The degree of the pleasantness of the scent is shown in Figure 3. No questionnaire was filled out as unpleasant. Samples A, B, C, and E are rated as having a pleasant scent at the highest level of 3, in sample C is found to be the most pleasant by 80% of users. This assessment is vital because the samples differ in the percentage of aromas, so this is an essential factor in evaluating the odor effectiveness of organic floor cleaners.

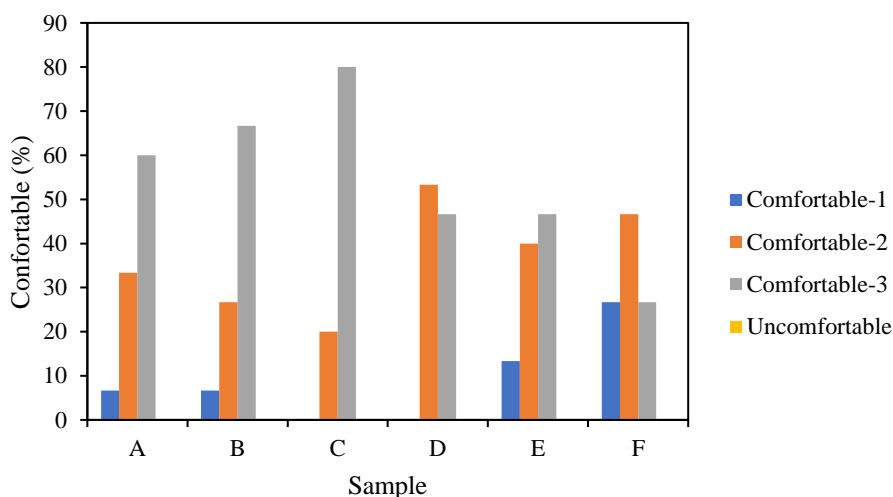


Figure 3. Comfort level when using 6 samples

Figure 4 shows the level of incense retention in 6 samples. 100% of samples do not show fragrance retention from 1 to 3 hours. The scent lasts up to about 30 minutes. This time can be quite long because the floor area is often large, so it is easy to smell. The scent may last longer in a narrow space environment such as the floor of a toilet or bathroom. Sample B is more than 90% rated as the longest-lasting scent, possibly due to the nature of the scent essence.

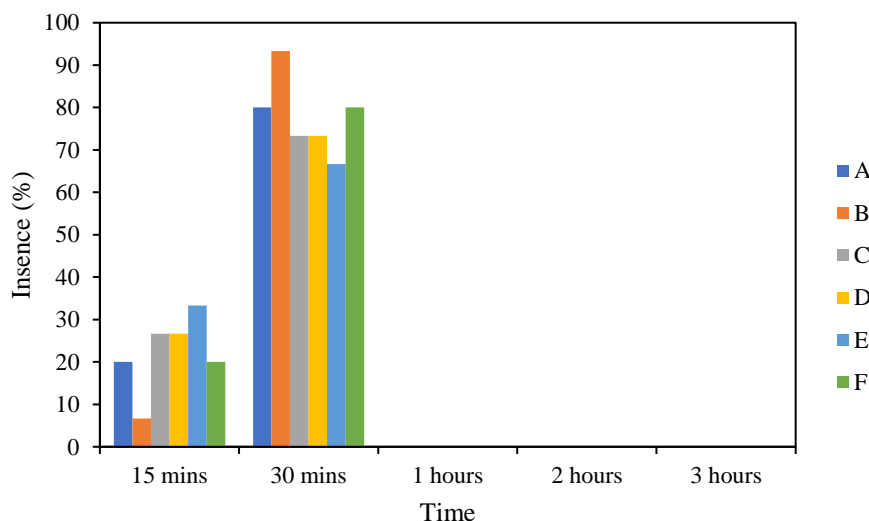


Figure 4. The level of scent retention of 6 samples

Changes in use over time

According to Figure 5, none of the samples was evaluated as having a significant reduction in scent. Over 80% of samples scents did not decrease under good storage conditions. Samples C and E nearly 100% agree that the scent is not reduced.

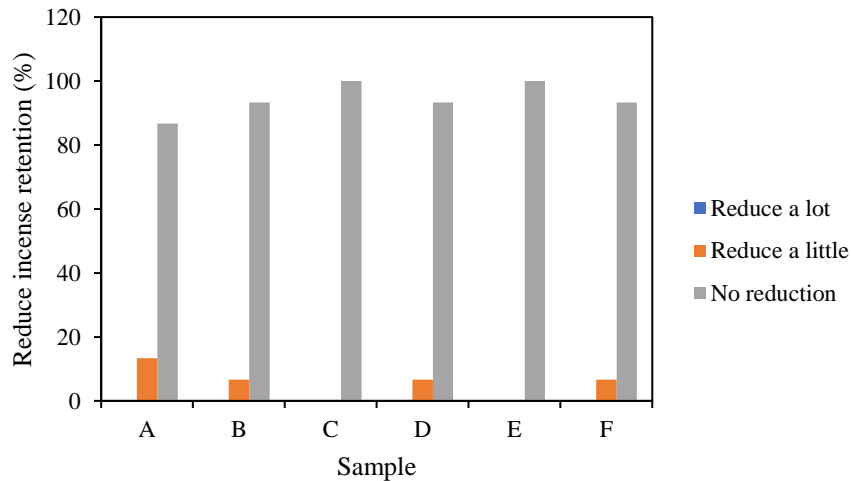


Figure 5. Degree of scent change

100% of the survey questionnaires found little sediment in 6 cleaning samples when left from the first to the last day of the survey. The residues are minimal in size and do not cause discomfort to the user.

Impact on user's health

The survey questionnaires did not find any health effects after using 6 samples of water for a long time, namely, no skin irritation; Children do not have irritation, rash, no respiratory problems (within one week of use).

In addition to the above survey ideas, people feel that combining the scent of samples with lemongrass and coriander also makes the mind more comfortable and the body more comfortable when using chemical products. Especially when wiping in an air-conditioned room, the scent feels longer and more pleasant.

Thus, after surveying 30 people using 6 product samples, the research team found that sample C (ratio of soapberry: cinnamon : distilled water: lemongrass essential oil: coriander essential oil is 30:30:38: 1:1) is a highly rated product. Based on the survey results, the research team made the following changes to the product:

- Conduct 2-layer filtration with the solution to reduce the rate of sediment
- Add Glycerol to increase preservation and reduce the evaporation rate

Then determine the sample phase ratio as follows:

1L floor cleaning solution includes: 300ml soapberry: 300ml essential oil: 380ml distilled water: 10ml Glycerol: 5ml coriander essential oil: 5ml lemongrass essential oil

3.3. Test results according to TCVN

The test results for the floor cleaning sample are shown in the following table. The results in the table show that the organic floor cleaner sample did not exceed the allowable standards, TCVN 12589:2018, Floor cleaner – technical requirements and test methods

Table 5. Test results

No.	Target name	Unit	Test method	Results
1	Status			Liquid, homogeneous, without layering or precipitation at temperatures below 20oC
2	Color, smell			Brown, clear Characteristic scent
3	Asen Conc. (As)	mg/kg	ACM THA 05+ AOAC 2015.01	No detect (LOD = 0,1)
4	Metal Conc.	mg/kg	TCVN 6971:2001 TCVN 12589:2018	<2,0
5	Residue content, % mass	g/ml	ASTM D 1290	0,035
6	Content of non-volatile matter (total solids), % by mass	g/ml	ASTM D 2834	
7	pH		pH meter	6,5
8	Stability at 50oC for 8h			No precipitation

4. CONCLUSION

Organic floor cleaner is synthesized from soapberry, cinnamon, lemongrass essential oil, and coriander essential oil, which are ingredients of natural origin, containing active ingredients capable of cleaning and scent. Fragrant, suitable for human health, such as saponins, cinnamic aldehydes, citral, and geraniol. The optimal ratio for floor cleaning water is: 1L of floor cleaning solution including 300ml soapberry: 300ml essential oil: 380ml distilled water: 10ml Glycerol: 5ml coriander essential oil: 5ml lemongrass essential oil.

Natural floor cleaner with ingredients of natural origin does not contain harmful chemicals, does not cause skin irritation or some respiratory diseases, and is safe for users, especially children. The scent of organic floor cleaner comes from natural ingredients and aromatic essential oils; although not durable over time, it is entirely non-toxic and suitable for human health. In addition, compounds in organic floor cleaning water, when discharged into the environment, are easy to decompose, causing no pollution to water sources and the environment.

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**NGHIÊN CỨU TỔNG HỢP NƯỚC LAU SÀN HỮU CƠ
TỪ MỘT SỐ LOẠI THẢO DƯỢC THIÊN NHIÊN**

Tóm tắt: Nghiên cứu trình bày quy trình tổng hợp nước lau sàn hữu cơ từ cao bồ hòn, tinh dầu quế, tinh dầu mùi già và tinh dầu sả chanh. Các tỷ lệ tổng hợp khác nhau được đưa ra và khảo sát qua ý kiến người sử dụng để đưa ra tỷ lệ tối ưu. Sản phẩm nước lau sàn hữu cơ đạt được tiêu chí sạch, sát khuẩn, không bám dính và mùi hương nhẹ lưu lâu ở tỷ lệ 1L dung dịch lau sàn bao gồm: 300ml dd cao bồ hòn: 300ml dd vỏ quế: 380ml nước cất: 10ml Glycerol: 5ml tinh dầu Mùi già: 5ml tinh dầu sả chanh. Mẫu nước lau sàn tối ưu đã được phân tích theo Tiêu Chuẩn Việt Nam (TCVN) 12589:2018, Nước lau sàn – yêu cầu kỹ thuật và phương pháp thử

Từ khóa: Nước lau sàn, cao bồ hòn, tinh dầu quế, tinh dầu mùi già và tinh dầu sả chanh