CINNAMALDEHYDE EXTRACTED FROM CINNAMON MULCH TO FORMULATE SOAP AND SKIN SCRUBBER FORMULAS

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Cinnamon is a common spice widespread in Sri Lanka, where cinnamaldehyde is found to be the main constituent of the cinnamon bark oil. Due to the presence of Cinnamaldehyde, these species exhibit antibacterial, antioxidant, and anti-inflammatory properties. Cinnamon species indigenous to Sri Lanka belong to the genus *Cinnamomum Zeylanicum*. The parts of the cinnamon tree are used for different purposes. Cinnamon mulch is the outermost bark layer of the cinnamon tree species, which is discarded as a fertilizer rather than being used for any other purposes. Therefore, this research work aims to use the cinnamaldehyde extracted from cinnamon mulch to be used as an ingredient in the process of soap and scrubber formulation. The cinnamon mulch for this study was obtained from the Southern province of Sri Lanka. The percentage yield of oil extracted using the hydro distillation method followed by solvent extraction using hexane and ethyl acetate and resulted in a yield percentage of 0.75% from the essential oil of cinnamon mulch. The extracted essential oil was analysed using High Performance Liquid Chromatography (HPLC) with the DAD detector. A soap was formulated using the cinnamon mulch, sandal wood, turmeric powder, rose water, glycerin, vitamin E and essential oil extracted from mulch as one of the ingredients and the antioxidant activity of the formulated soap using cinnamon mulch was evaluated using the DPPH (2,2-Diphenyl-1-picrylhydrazyl) scavenging assay along with Trolox as the standard. The IC_{50} value corresponding to the soap formulation was 0.146 mg/mL and the standard (Trolox) was 0.002 mg/mL, revealing that the formulated soap possesses good antioxidant properties. This study reveals that a significant yield of oil can be extracted from cinnamon mulch using hydro distillation, which possesses a considerable amount of cinnamaldehyde with good antioxidant properties that can be used to formulate a product rather than discarding it as a fertilizer.

Keywords: Cinnamon mulch, *Cinnamomum Zeylanicum*, IC_{50}, antioxidant activity, HPLC

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INTRODUCTION

Essential oils are used for medicinal, cosmetic and other applications. It is found in various parts of plants, which is collation and has an odour like the original plant[1]. Cinnamon is an evergreen tree belonging to the genus *Cinnamomum.* Ceylon cinnamon is known as *Cinnamomum zeylanicum.* The composition of the oil varies depending on the part of the plant used, the age of the tree, the season, the location, and the extraction methods employed. Cinnamaldehyde is the primary constituent in bark oil, eugenol predominates in leaf oil, while camphor is the major component in root-bark oil[2]. Cinnamaldehyde and eugenol are natural compounds with a variety of biological activities such as antimicrobial, antioxidant, anti-inflammatory, and cytotoxic[3].

Cinnamon mulch is the outermost layer of the cinnamon tree, which is removed during the cinnamon bark production process. It consists of aromatic compounds and the natural properties of cinnamon. Essential oils can be extracted in many ways, as conventional and advanced methods. Among them, hydro-distillation and organic solvent extraction are conventional methods.

The extracted cinnamon oil can be analysed using High Performance Liquid Chromatography (HPLC). HPLC is a method mostly used to determine qualitatively and quantitatively as the retention time and Ultraviolet (UV) spectrum (by photodiode array (DAD) detector) of isolated material on HPLC was completely identical to that of standard cinnamaldehyde[5].

Herbal skin scrubber or soap are natural skin care products which have no harsh chemicals, or artificial fragrances. They are formulated with plant-based extracts. Essential oils extracted from herbal plants possess numerous skin care benefits as well as adverse effects[6].

Antioxidants are substances that can delay or prevent various harmful effects of free radicals, as they are the main factor in causing skin ageing. Reactive oxygen compounds are free radicals that can bind to surrounding molecular electrons. The excessive oxidation can cause damage to cells and degeneration. Hence, antioxidants will protect cells and neutralize free radicals[7]. The grade of discolouration indicates the inhibition potential of antioxidant compounds in terms of electron/ H-donating ability[8].

The cinnamon mulch is the outermost layer of cinnamon bark formed during cinnamon bark production, where it is discarded as a fertilizer rather than being

used for advanced purposes. As a solution, cinnamon mulch and oil extracted from cinnamon mulch are used as one of the ingredients to formulate a soap. So, in this research, the study is based on extracting cinnamon mulch essential oil, determining the yield of essential oil, analysing the composition of essential oil using HPLC, formulating the soap using cinnamon mulch and its essential oil and determining its antioxidant properties.

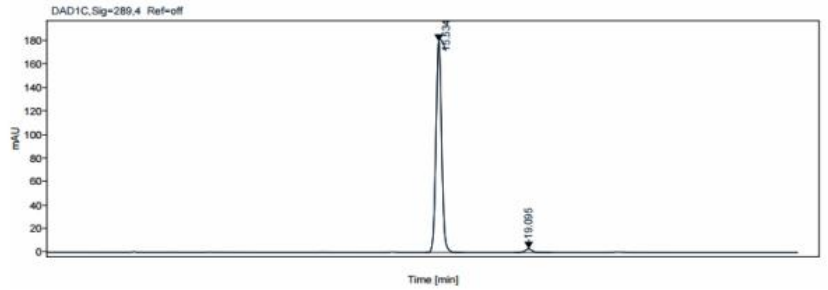
METHODOLOGY

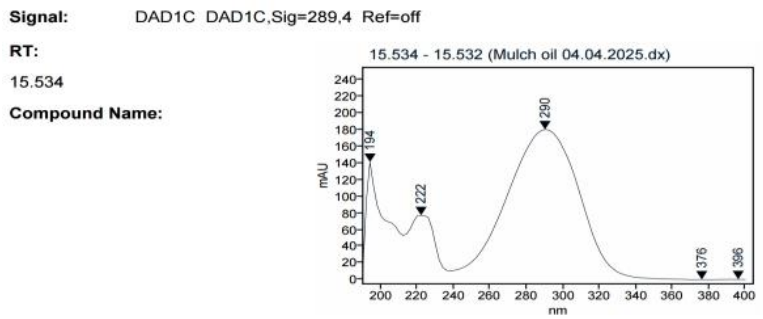
The cinnamon mulch was collected from the Southern Province of Sri Lanka. Extraction of essential oil was followed according to Redha et al. (2020)[11] with slight changes. The HPLC analysis for the extracted oil was performed according to Wong et al. (2014)[5] with slight changes. The procedure for the soap preparation was followed according to Pallavi et al. (2024)[6] with slight changes in ingredients. The antioxidant activity was carried out according to Abeysinghe et al. (2021)[10] with minor modifications.

RESULTS AND DISCUSSION

Cinnamon bark oil possess 1.9% of yield using hydro distillation according to (Redha et al., 2020)[11] .The percentage yield of essential oil extracted from cinnamon mulch (10 g) is 0.75%. Hence, the essential oil of cinnamon mulch possesses half the yield of cinnamon bark oil. The essential oil of cinnamon mulch was clear and had no colour but possessed a pleasant fragrance which is very mild.

The HPLC chromatogram of cinnamaldehyde in cinnamon mulch essential oil and its UV/DAD are shown in Fig 1. The HPLC analysis was done at 289 nm. Two peaks were eluted at retention times 15.534 min (290 nm) and 19.095 min (194 nm). The peak at 15.534 min is concluded as the peak corresponding to cinnamaldehyde when compared with the results of (Bandusekara et al., 2023)[4].





T (min)	idth (min)	rea	eight	rea %
.534	5333	06.9430	9.6537	.8542
.095	4667	.5518	0566	1458

Figure 1: HPLC chromatogram of cinnamon mulch oil and its respective DAD signal

Evaluation results of soap

The soap formulated using cinnamon mulch was brown as shown in Figure 2. It consists a pleasant fragrance but not a strong fragrance. The soap was easily washable without remaining any oiliness or any other texture in the skin.

Figure 2: Scrubbing soap formulated with cinnamon mulch

Antioxidant Assay

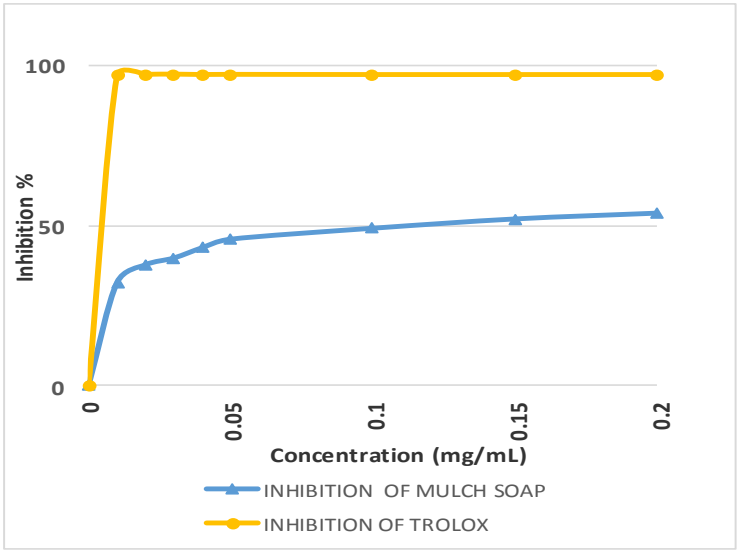


Figure 3: DPPH Assay Graph of Standard (Trolox) and Formulated soap.

Table 1 :IC_{50} values

ɔecies	**ɔ50 ŋg/mL)**
ɔap with ulch	146
rolox	002

The change of sample colour from purple to pale yellow signals the presence of antioxidants with successful scavenge of DPPH radical[9]. The standard used is Trolox which exhibit strong antioxidant activity of IC_{50} 0.002 mg/mL. The IC_{50} value of soap formulated using cinnamon mulch and mulch oil is 0.146 mg/mL. When the results are compared it conclude that the formulated soap require more concentration to reach IC_{50} than the standard but still possesses good antioxidant properties.

The IC_{50} values exhibit different properties according to its values. If IC_{50} <50 exhibit very strong antioxidants, 50-100 strong antioxidants, 100-150 moderate antioxidants, 151-200 weak antioxidants[7]. According to (Sadsyam et al, 2023)[7]

the formulated soap where IC_{50} value 0.146 mg/ml could scavenge the free radicals and possess strong antioxidant properties.

As shown in figure 3 the DPPH scavenging activity of trolox was increased with increasing concentration and arrived at a stable phase exhibiting good antioxidant activity. But the scavenging activity of the formulated soap increases the scavenging assay with the increase of concentration but deviates from the expected result. This may be due to slow kinetics.

CONCLUSION/RECOMMENDATIONS

The yield percentage of the essential oil extracted from cinnamon mulch is 0.75%. The HPLC analysis concluded the retention time for the detection of cinnamaldehyde in cinnamon mulch was 15.53 min at 290 nm. According to the study, the cinnamon mulch essential oil contains a considerable amount of cinnamaldehyde with a peak area of 97.85%.

So to conclude this study, a considerable amount of cinnamaldehyde is present in cinnamon mulch, and the formulated soap with cinnamon mulch and its oil exhibits antioxidant properties compared with the standard (Trolox) hence, cinnamon mulch can be used for many purposes other than discarding as a fertilizer.

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