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Preparation of Extract of Orange (Citrus Sinensis) Peel by Soxhlet: its GC-MS Analysis and Application in Perfume

Swati Vilhelkar[1], Hafsa Momin[2]

[1,2]Department of Chemistry, The Institute of Science, Madam Cama Road, Mumbai – 32.

ABSTRACT

The wastage of food production for humans lead to a serious problem globally. The Citrus peels contain high amount of an essential oil which is beneficial in many ways. Here, orange peel (Citrus Sinensis) extract has been extracted using Soxhlet method by distilled ethanol as a solvent. Soxhlet extraction method is used to extract compounds from a solid sample with the help of a solvent. The Soxhlet extraction method manifested to be efficacious in acquiring a high yield of essential oil, capable of utilizing the perfume industries for its efficiencies in aroma and potential bioactivity. The GC-MS analysis, mainly for volatile and semi-volatile compounds was carried out and applications in perfume has been shown. Many people feel the need to wear a fragrance to feel good, this is probably because there is a connection between scent and emotion as well as between scent and memory. Moreover, studies have shown that some fragrances can boost mood and even relieve anxiety and stress. The main purpose of this research was to highlight about the citrus waste, that have an ability to avail the development of sustainable practices in the extraction and application of citrus essential oils.

Keywords: Orange peel (Citrus Sinensis) extract, Soxhlet extraction, GC- MS Analysis, Fragrance

INTRODUCTION

Citrus Sinensis peels, often considered waste in citrus juice manufacturing industries, hold significant capability as a source of essential oils that are rich in bioactive compounds. It evinces several health potential benefits, including antioxidant, antimicrobial and anti-inflammatory properties. It is used in various cosmetic products and fragrances. It also exhibits medicinal uses such as to treat and prevent vitamin deficiencies, colds, flu and scurvy [1]. The extraction and analysis of which, gives rise to various applications, particularly in the perfume industry where natural fragrances are prominent. This research focuses on the GC-MS analysis of extracts from orange (Citrus sinensis) peels obtained using the Soxhlet method. The Soxhlet extraction method is a widely used technique for separating essential oils from plant materials due to its efficiency in extracting compounds with minimal solvent usage. GC-MS analysis is a powerful technique for identifying and quantifying the volatile compounds present in these extracts.

Figure 1 – Orange (Citrus Sinensis) Peel

MATERIALS AND METHODS

Experimental Area:

This research work was carried out in the Chemistry Laboratory of The Institute of Science, Dr. Homi Bhabha State University, Mumbai.

Chemicals used for Extraction:

The chemical used for this work is ethanol of laboratory grade from Loba Chemicals, Distilled water. The glass wares used for this work were round bottom flask, basket heater, Soxhlet extractor (along with siphon arm), condenser, measuring cylinder, beaker and funnel [1].

Preparation of perfume:

1. Son Chafa Flower

Son Chafa (Magnolia Champa) contains phenolic acids, aglycone flavonoids, glycosidic flavonoids and lignans. It has various medicinal uses, the oil which is extracted from its flowers is used to treat rheumatism, eye issues and gout. Chafa Flowers have a wide impact on fragrances on clothes during ceremonies. It also results in destroying the germs present in the blood [2].

Figure 2 – Son Chafa (Magnolia Champa) flowers

2. Galaxolide

Galaxolide is an organic heterocyclic compound. It is a synthetic musk with a sweet floral musky woody odor that is used in fragrance. It is also used as fabric softener [2].

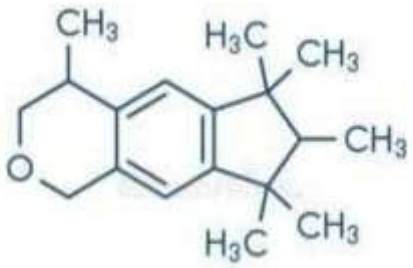

Figure 3 – Galaxolide

3. Ethanol

Ethanol is used as an agent in pharmaceutical preparations to prevent skin infections. It is present in fuels and in the preparation of various chemical compounds, polymers and perfumes. It is an excellent solvent and has a wide range of applications in chemistry [2].

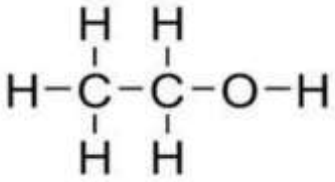

Figure 4 - Ethanol

4. Orange (Citrus Sinensis) peel extract

The Preparation of Extract was carried out in following steps: -

4.1) Orange Zest Formation

4.2) Distillation of Ethanol

4.3) Soxhlet Extraction

4.4) Evaporation of Solvent through rotatory evaporator

4.1 Orange Zest Formation

Fresh oranges were purchased from local market, peeled off. Their peels were washed and air dried to remove excess moisture. Further, were grated to obtain the zest of fresh skin. Zest of fresh skin were ultimately used for the experimentation as shown in figure 5.

Figure 5 – Orange Zest

4.2 Distillation of Ethanol

Ethanol distillation is a process that separates ethanol from a mixture by heating the mixture until the ethanol evaporates, then condensing the ethanol vapors. Since water evaporates after ethanol, the ethanol rises through a tube, accumulates and condenses into another container, the water is left behind. As different liquids have different boiling points, when a mixture is heated, the substance with lower boiling point will boil first, vaporize and condense that can be collected separately from other substances of the mixture. Distillation of ethanol has been prepared prior extraction of orange peel and specifically this distilled ethanol was used for the experiment (rather than normal ethanol) to obtain pure essential oil as shown in figure 6.

Figure 6 – Distillation of Ethanol

4.3 Soxhlet Extraction

Soxhlet extraction method was used to extract compounds from an orange zest using a solvent. The solid sample, 30g orange zest, had been extracted and distilled ethanol was used as a solvent. The round-bottom flask containing the solvent was heated, causing it to evaporate and vaporize. The vapor was then condensed in the condenser and retreated into the solid sample in the extraction chamber. The extracted compounds were collected in the round-bottom flask increasing the concentration of the orange peel constituents with the solvent for further processing and analysis [1].

Figure 7 – Soxhlet Extraction

4.4 Evaporation of Solvent through Rotatory Evaporator

The liquid sample is placed in a round bottom flask that is rotated at a constant speed while being heated simultaneously. This causes the liquid to evaporate, leaving behind any solid impurities or other substances. The evaporated liquid vaporizes and is then condensed by the water-cooled condenser. This converts the vapor back into a liquid, which is then collected in a separate attached round bottom flask, while any remaining impurities or unwanted substances are discarded. The oil and solvent (ethanol) mixture were separated using rotary evaporator as shown in figure 8. and the separation was carried out by principle of rotatory evaporator. Hence ethanol was distilled out and pure oil was obtained in the round bottom flask.

Figure 8 – Rotatory Evaporator

Observation Table

Sr. No	Characteristics	Measurements
1	Distillation Temperature	40 Degree C
2	Separated Ethanol	115 ml
3	Density of oil	1.079625 g/ml
4	Amount of oil	4 ml
5	Yield of extraction	7.19% (weight of oil extracted/weight of sample used*100)

The pure oil was stored in a container for further analysis as shown below

Figure 9 – Orange peel extract

GC-MS Analysis Characterization

The GC-MS analysis mainly for volatile and semi-volatile compounds was carried out and the orange peel extract was prepared in distilled ethanol. The experiment was performed by using a gas chromatography equipped with1.00 ml/min capillary column as well as FTD. The carrier's gas flow was managed at a rate of 1ml/min. Simultaneously the injector was operated at 250ºC [3]. The GC-MS analysis was conducted using GCMS-QP2010 Ultra. The column oven temperature was kept at 50ºC and was programmed from 50ºC to 275ºC. The plot is showing about total ion current (TLC) or peak intensity versus retention time (RT).

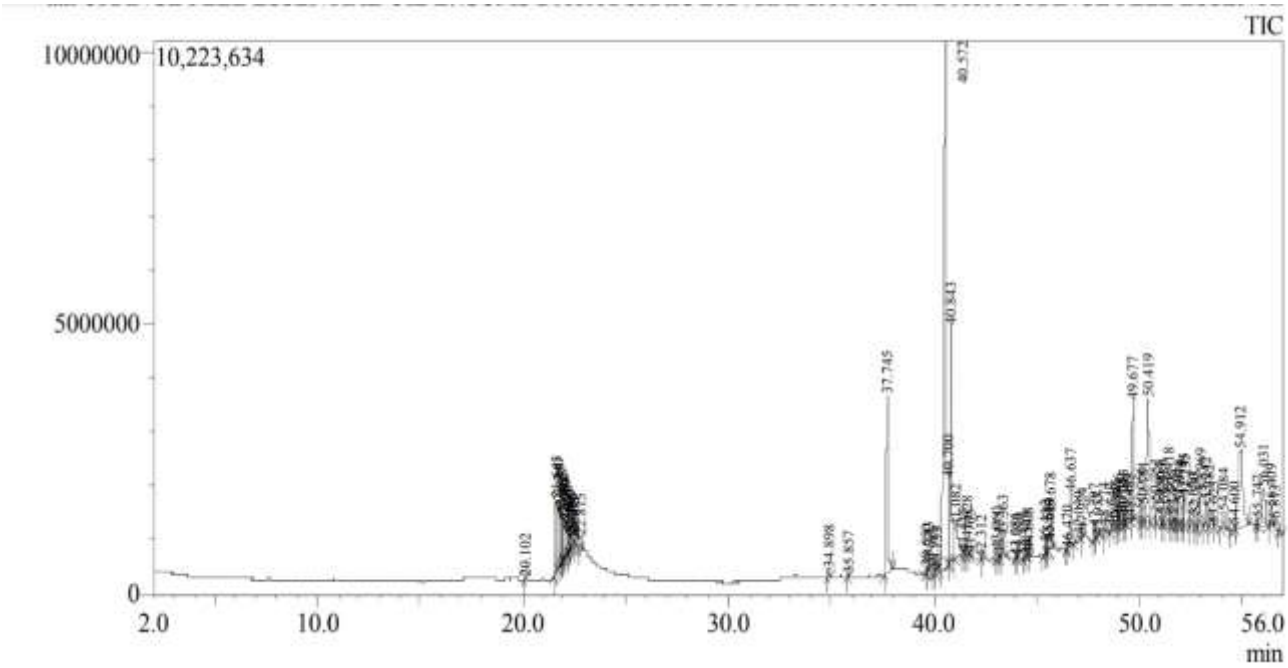

Figure 10 – GC-MS analysis report of orange peel extract

Applications in perfume

Preparation of Son Chafa Extract

The Extraction of Son Chafa flowers was prepared using distilled ethyl alcohol as a solvent to obtain pure extract. The Flowers were purchased from local market, washed and Air dried. Their petals were broken into smaller parts. About 100 grams of petals were collected and were dipped overnight for about 15 hours

by 400 ml distilled ethanol in the round bottom flask. Extraction of ethanol has been done to distill the ethanol and to obtain pure Son Chafa extract from it. The obtained Son Chafa extract was stored for further formulation of perfume.

Figure 11 – Son Chafa Extract

Formulation Table:

Sr. No	Ingredients	Quantity	Percentage
1	Son Chafa extract	5 ml	20%
2	Orange peel extract	0.5 ml	2%
3	Distilled Ethyl alcohol	19.25 ml	77%
4	Galaxolide	0.25 ml	1%

Methodology

- For the formulation of 25 ml perfume, take 5 ml of Son Chafa extract
- Add 0.5 ml of orange peel extract
- Add 19.25 ml distilled ethyl alcohol and 0.25 ml galaxolide to it
- Fill it in aerosol container for further use

Figure 12 – Formulated perfume

Evaluation tests

- **Fragrance Test**

For Evaluation, fragrance test has been done on fragrance test paper also known as blotter to test the aroma of perfume[2]

It was a sweet floral scent.

- **Skin Test**

Perfume was sprayed on different skin type individuals, allowing it to dry on its own without rubbing it deliberately[2]

No redness, irritation or swelling has been observed.

RESULT

Review about perfume

The formulated perfume was provided to different individuals and the response was noted. Herein the effect of perfume on different factors like, tanning, longevity, stimulative, intensity, Substantiality, etc. were noted on different skin types. Most favored area of excellence of the perfume was for the substantial and stimulative properties wherein individual find the Perfume to have a mood boosting, mindfulness refreshing vibe and the ability of that to adsorb on the skin. The longevity properties of the aroma and scent are also effective but to a lesser extent. Overall, the perfume used is proven to be effective and having no side effects and any type of irritation.[4]

INDIVIDUAL NAME	NO. OF DAYS USED	RESPONSE MARKED WITH PERCENTAGE OUT OF 100%					
		LONGEVITY	INTENSITY	SUBSTANTIALITY	STIMULATIVE	DIFFUSION	REVIEW
HAFSA	7	80	85	95	100	90	REFRESHING
MARYAM	7	70	80	100	90	95	PRODUCTIVE
ALI	7	75	70	90	90	100	GOOD
UMAR	7	80	80	85	100	80	USEFULL
TASMIA	7	75	90	100	85	85	SOOTHING & PEACEFUL

Precautions to be taken

It is essential to take some precautions to ensure about the results without any inauspicious effects. Firstly, perform a patch test on a small area of your skin before using it in more amount. Avoid spraying perfume too close to eye area as it is delicate. Read the Instructions mentioned on the packaging carefully. Abstain

wearing perfume on Sensitive, broken or inflamed skin. In case of any irritation or other allergic reactions refrain it immediately.

CONCLUSION

The use of orange peel oil as an essential oil is a great step towards a green environment. Rather than being a waste and pollution it can participate towards a better perspective. It has a wide range of applications, anti-inflammatory, antioxidant properties, in cosmetics and perfumes formulations, etc. Perfume formulated in this article was prepared using herbal ingredients like Son Chafa, orange peel extract which does not cause any side effects. It relieves and satisfies the user.

REFERENCES

1. Hemlata Karne, Vedvati Kelkar, Apoorva Mundhe, Mitesh Ikar, Shantanu Betawar, Nikita Chaudhari, Essential Oil Extraction from Orange and Lemon Peel, Department of Chemical Engineering, Vishwakarma Institute of Technology, Pune, India, E3SWeb of Conferences 455, 01005 (2023)
2. Matoshri Miratai , Formulation and Study of Organic Perfume, Aher College of Pharmacy, International Journal of Research Publication and Reviews, Vol 4, no 4, pp5195-5201 April 2023
3. P. B. Cholke, A. K. Bhor, A. M. Shete, R. K. Sonawane, EXTRACTIONANDGC-MS ANALYSIS OF ORANGE (CITRUS SINENSIS) PEEL OIL,Waghire College Saswad, Pune 412301, 2017 Jan-Feb RJLBPCS 2(5) Page No.41
4. Swati Vilhelkar, Sumit Tiwari, Extraction of Magnolia Champa Flowers Using Soxhlet and its Application in Red Lentil Face Pack, International Journal for Multidisciplinary Research (IJFMR), February 2025
5. Ozturk, Baranse. "Green Processes for Deterpenation of Essential Oils and Extraction of Bioactive Compounds from Orange Peel Waste", The University of Manchester (United Kingdom), (2020)
6. 6)https://pmc.ncbi.nlm.nih.gov/articles/PMC9864618/#:~:text=Aqueous%20orange%20peel%20extract%20had,total%20microbial%20count%20%5B19
7. Chanthaphon A., Chanthachum, S. and Hongpattarakere T. Antimicrobial Activities of Essential Oils and Crude Extracts from Tropical Citrus spp. Food- Related Microorganisms. Songklanakarin J. Sci. Technol. 30(1): 125-131 (2008)
8. Muhammad M. Effects of Different Extraction Methods on Yield of Essential Oil from Orange Peels. Undergraduate Thesis, Abubakar Tafawa Balewa University, Bauchi, Nigeria (2017)
9. Gavahian, M., Chu, Y.-H. and Mousavi Khaneghah, A, Recent advances in the orange oil extraction: an opportunity for the valorization of orange peel waste a review. Int J Food Sci Technol, 54: 925-932 (2019)
10. Joy PP, Thomas J, Mathew S, Skaria BP. Medicinal plant, Naya Prokash, Calcutta, 2001: 449-632.
11. Kobayashi A, Kubota K, Anzai Y, Cheng M, Yamanishi T. In: Proceedings of the29th symposium on the chemistry of terpenes, essential oils and aromatics, 1985: 129. Mie, Japan. Also reviewed by Lawrence B. Perfum Flavor 1992; 17: 68-71.
12. Shalaby A, Hassan H. Ind Perfume 1989; 33: 268-273.
13. Kamal, G.M.; Anwar, F.; Hussain, A.I.; Sarri, N.; Ashraf, M.Y., 2011, Yield Chemical composition of Citrus essential oils as affected by drying pretreatment of peels. International Food research Journal 2011, 18(4), 1275-1282.
14. Chemo, Beginners guide to Soxhlet extractions, April 2003.