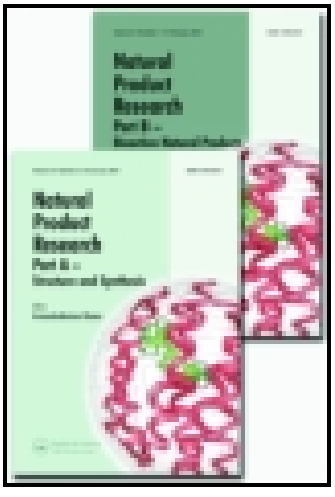

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Bioanalytical evaluation of Cinnamomum zeylanicum essential oil

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SHORT COMMUNICATION

Bioanalytical evaluation of *Cinnamomum zeylanicum* essential oil

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This manuscript describes the antioxidant activity of essential oil of Cinnamon (*Cinnamomum zeylanicum*) bark extracted by supercritical fluid extraction (SCFE), hydro distillation and steam distillation. The cinnamon bark essential oil exhibited a wide range of total phenolic contents, total flavonoid contents, reducing power, inhibition of linoleic acid peroxidation and DPPH radical-scavenging activity (IC50). Bioactivity of cinnamon essential oil was assayed against various bacterial strains including *Bacillus subtilis*, *Escherichia coli*, *Pastrurella multocida* and *Straphylococcus aureus* and fungal strains including *Aspergillus niger* and *Aspergillus flavus*. More essential oil yield was obtained using SCFE in comparison to other methods. The oil extracted by SCFE was dominated by cinnamaldehyde, limonene, copaene, naphthalene, heptane, bicyclo[4.2.0]octa-1,3,5-triene and 2-propenal. Due to the presence of cinnamaldehyde in the essential oil of cinnamon bark it acts as a good antioxidant and antimicrobial agent.

Keywords: cinnamon; antibacterial; antifungal; cinnamaldehyde; antioxidants

1. Introduction

Cinnamon (*C. zeylanicum*) is a spice extracted from the inner bark of various trees used in both sweet and savoury foods belonging to the genus Cinnamomum. While *Cinnamomum verum* is sometimes assumed to be 'true cinnamon', most cinnamon in international business is extracted from allied species, which are also considered to as 'cassia' to differentiate them from 'true cinnamon' (Cheng et al. 2006; Wang et al. 2009; Özcan & Arslan 2011). Cinnamon essential oil is mainly used in perfume and in flavour industries; in addition to this, they have also been extensively used as preservatives in food and pharmaceutical industries. Due to their flavour enhancing properties these are used in perfume and special care products. Other applications of essential oils include in paint and textile industries. The essential oils contain various active

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phenolic compounds which can provide protection from different harmful effects of the microbes (Znini et al. 2013). The present research work has been undertaken to compare the yield and chemical composition of Cinnamon (*C. zeylanicum*) essential oil extracted by hydro distillation, steam distillation and supercritical fluid extraction (SCFE) methods and to find out the antimicrobial and antioxidant activities of essential oil extracted from this species.

2. Results and discussion

Essential oil from the bark of *C. zeylanicum* was extracted by hydro distillation (0.93%), steam distillation (0.87%) and SCFE (1.6%). The chemical composition of all samples verified using GC–MS analysis is given in Table 1. The GC–MS analyses of the oil samples by hydro distillation, steam distillation and SCFE analysis revealed the presence of a total of 58 (99.98%), 52 (99.99%), 33 (99.93%) components, respectively. Cinnamaldehyde-(E), limonene and copaene dominated oil obtained using all extraction techniques used. However, high temperature and direct heating decomposed maximum compounds in the hydro distillation followed by steam distillation. As low temperatures were used in SCFE, there were minimum chances of decomposition (Lohani et al. 2012; Hussain et al. 2013). Antioxidant activity of *C. zeylanicum* essential oil extracted by various extraction techniques was accessed by determining total phenolics contents (TPC), total flavonoids contents (TFC), reducing power ability, DPPH radical scavenging activity and percentage inhibition in linoleic acid system. The amount of TPC and TFC in *C. zeylanicum* essential oil ranged from 0.07 to 0.91 mg/g and 0.9 to 1.87 mg/g, respectively, in the following order: hydro distillation > steam distillation > SCFE. DPPH scavenging activity was also similar to above given order. The antioxidants activity has also been assessed as ability to prevent from oxidation. All essential oils exhibited appreciable inhibition of per oxidation ranging from 57.8% to 69.61% for essential oils extracted using various extraction methods. The ability of essential oils as extracted by various oil extraction techniques to inhibit the linoleic acid peroxidation was in the following order: SCFE > steam distillation > hydro distillation. The reducing potential of essential oils was measured for the concentration up to 2.0 mg/mL; this showed general increase in activity when concentration was increased. Reducing potential of essential oil at 2 mg/mL ranged from 0.911 to 1.911. Disc diffusion method was used to investigate the antimicrobial activity of essenttial oil of *C. zeylanicum* against four bacterial strains, *Pasturella multocida*, *Escherichia coli*, *Bacillus subtilis* and *Straphylococcus aureus* and two fungal strains *Aspergillus niger* and *Aspergillus flavous* (Table 2). *B. subtilis* and *S. aureus* are gram positive bacteria whereas *E. coli* and *P. multocida* are gram negative bacteria. The demonstration of antibacterial activity of *C. zeylanicum* against both Gram-positive and Gram-negative bacteria may be indicated by the presence of broad spectrum antibiotic compounds (Yeh et al. 2009; Salem et al. 2013; Ghosh

Table 1. GC–MS analysis (%) of *Cinnamomum zeylanicum* essential oil extracted by various methods.

Sr. no.	Components	RT	Hydro distillation	Steam distillation	SCFE
1	α-Pinene	1.6101	2.69	0.75	–
2	Limonene	2.1538	15.10	14.36	14.00
3	Cinnamaldehyde (E)-	5.2111	49.15	48.80	25.10
4	Copaene	7.0116	6.19	9.35	15.14
5	β-Cadinene	9.5977	–	3.08	–
6	δ-Cadinene	10.0869	3.31	–	10.30
7	Calamenene	10.1052	–	5.58	
8	3,7 (II)-Salinadiene	16.008	–	–	4.71
9	Amorphene	16.326	–	–	7.56
10	*O*-methoxycinnamaldehyde	16.733	–	–	2.06

Table 2. Antimicrobial activity (inhibition zones, mm) of *Cinnamomum zeylanicum* essential oil against various bacteria.

Microorganism	Hydro distillation	Steam distillation	SCFE	Positive control
B. subtilis	21.0	17.2	27.0	30.0
E. coli	15.0	12.3	17.5	22.5
S. aureus	22.0	17.0	21.0	28.0
P. multocida	20.0	18.0	17.9	29.5
A. Nigar	14.3	11.2	21.3	27.3
A. flavus	13.1	11.67	21.5	26.5

et al. 2014; Jouki et al. 2014). These findings are quite similar with the previous results which reported that cinnamon bark oil fully inhibited the growth of some Gram positive and Gram negative bacteria, fungi and yeasts (Yeh et al. 2009; Salem et al. 2013).

3. Conclusion

The present study provided the potential antimicrobial and antioxidant properties of the essential oil of cinnamon bark. Essential oil of *Cinnamomum zeylanicum* exhibited good antioxidant activity and antimicrobial activity. Investigated essential oil may be used to preserve foods as well as pharmaceutical and natural therapies for treatment of infectious diseases in human and plants. Moreover, the potency of the constituents such as copaene, limonene and cinnamaldehyde could provide a chemical basis for some of the health benefits claimed for cinnamon and warrant further studies to assess their potential as effective natural remedies.

Supplementary material

Experimental details relating to this paper are available online.

References

Cheng S-S, Liu J-Y, Hsui Y-R, Chang S-T. 2006. Chemical polymorphism and antifungal activity of essential oils from leaves of different provenances of indigenous cinnamon (*Cinnamomum osmophloeum*). Bioresour Technol. 97:306–312.

Ghosh S, Ozek T, Tabanca N, Ali A, ur Rehman J, Khan IA, Rangan L. 2014. Chemical composition and bioactivity studies of Alpinia nigra essential oils. Ind Crops Prod. 53:111–119.

Hussain J, Rehman N, Al-Harrasi A, Ali L, Khan AL, Albroumi MA. 2013. Essential oil composition and nutrient analysis of selected medicinal plants in Sultanate of Oman. Asian Pac J Trop Dis. 3:421–428.

Jouki M, Mortazavi SA, Yazdi FT, Koocheki A. 2014. Characterization of antioxidant–antibacterial quince seed mucilage films containing thyme essential oil. Carbohydr Polym. 99:537–546.

Lohani H, Andola HC, Chauhan N, Bhandari U. 2012. Variability in volatile constituents of *Cinnamomum tamala* leaf from Uttarakhand Himalaya. Asian Pac J Trop Biomed. 2(2):S667–S669.

Özcan MM, Arslan D. 2011. Antioxidant effect of essential oils of rosemary, clove and cinnamon on hazelnut and poppy oils. Food Chem. 129(1):171–174.

Salem MZM, Ali HM, El-Shanhorey NA, Abdel-Megeed A. 2013. Evaluation of extracts and essential oil from *Callistemon viminalis* leaves: antibacterial and antioxidant activities, total phenolic and flavonoid contents. Asian Pac J Trop Med. 6(10):785–791.

Wang R, Wang R, Yang B. 2009. Extraction of essential oils from five cinnamon leaves and identification of their volatile compound compositions. Innovative Food Sci Emerg Technol. 10:289–292.

Yeh R-Y, Shiu Y-L, Shei S-C, Cheng S-C, Huang S-Y, Lin J-C, Liu C-H. 2009. Evaluation of the antibacterial activity of leaf and twig extracts of stout camphor tree, *Cinnamomum kanehirae*, and the effects on immunity and disease resistance of white shrimp, Litopenaeus vannamei. Fish Shellfish Immunol. 27:26–32.

Znini M, Cristofari G, Majidi L, Paolini J, Desjobert JM, Costa J. 2013. Essential oil composition and antifungal activity of *Pulicaria mauritanica* Coss., against postharvest phytopathogenic fungi in apples. LWT Food Sci Technol. 54:564–569.