International Journal of Science, Environment and Technology, Vol. 8, No 3, 2019, 636 – 640
ISSN 2278-3687 (O)
2277-663X (P)

CHARACTERIZATION AND ANTIOXIDANT ACTIVITY OF ORANGE PEEL EXTRACTS

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Abstract: Orange fruit peels have been utilized for long as an active ingredient in most of the traditional medicines. Various solvents like methanol, ethanol, dichloromethane, acetone hexane and ethyl acetate were used for the extraction of orange peel. In this study, the methanol extracts were subjected to Gas Chromatography Mass Spectrometry (GCMS) for chemical characterization andthe aqueous extract was assessed for free radical scavenging ability against 2, 2 – diphenyl – 1 picrylhydrazyl (DPPH) for its antioxidant property. Characterization of orange peel indicated the presence of compounds like catechol, dimethoxy phenol, cyclohexane, coumarin, acetic acid, stigmasterol, sitosterol and vitamin E which are responsible for its antioxidant property. The aqueous extract of orange peel powder exhibited an antioxidant activity of 71.2 per cent.
Keywords: Orange peel, characterization, antioxidant activity.

Introduction

Orange constitutes about 60 per cent of the total citrus production in the world. A large portion of citrus production is addressed to the industrial extraction of citrus juice which leads to huge amounts of residues, including peel and segment membranes. Peels represent between 50 and 65 per cent of the total weight of the fruits and remain as the primary byproduct. If not processed further, it would produce odour, soil pollution, act asharborage for insects and could give rise to serious environmental pollution (Mandalari *et al.,* 2006). The oranges peels are rich in nutrients, which could be used as drugs or as food supplements (Ashok kumar *et al.,* 2011). The antioxidant property of the plant material is due to the presence of many active phytochemicals including vitamins, flavonoids, terpenoids, carotenoids, cumarins, curcumins, lignin, saponin, plant sterol etc (Lucia *et al.,* 2008). Citrus fruits and juices are important sources of bioactive compounds including antioxidants such as ascorbic acid, flavonoids, phenolic compounds and pectins that are important to human nutrition. The main flavonoids found in citrus species are hesperidine, narirutin, naringin and eriocitrin (Arora and Kaur, 2013). Epidemiological studies on dietary citrus flavonoids showed a reduction in risk of coronary heart disease and is attracting more and more attention

*Received May 2, 2019 * Published June 2, 2019 * www.ijset.net*

not only due to their antioxidant properties, but also as anti-carcinogenic and anti-inflammatory activities because of their lipid anti-peroxidation effects (Ghasemi *et al.,* 2009).In addition, citrus byproducts also represent a rich source of naturally occurring flavonoids. The peel which represents almost one half of the fruit mass contains the highest concentrations of flavonoids in the citrus fruit (Arora and Kaur, 2013). Keeping the above facts in mind, this study was aimed to characterize the orange peel powder in methanol extract and to assess its antioxidant activity in aqueous extract.

Materials and Methods

Mandarin variety of fresh orange fruits purchased from the local markets of Chennai were washed well, the peel were separated and cut into small pieces and then dried in fluidized bed drier (Milk Tech Engineers, Bangalore) for a period of 6-8hrs. The dried samples were ground properly into powder and were stored in air tight containers.

The aqueous extraction of orange peel powder was prepared by adopting the procedures outlined by Friedman *et al*. (2002) and Arora *et al*. (2013) with little modifications. Fifteen grams of powdered sample was dissolved in 200ml of distilled water at room temperature and kept in magnetic stirrer for 2hrs for efficient extraction. The extract was then filtered using whatman filter paper No.1 and stored at 4^0 till used.

The 2, 2 – diphenyl – 1 picrylhydrazyl (DPPH) at 0.2mM concentration was stored in amber coloured bottle and kept in a dark place. The DPPH radical scavenging activity (RSA) of orange peel powder was determined as per the method of Brand-Williams *et al*. (1995) with slight modification.

The free radical scavenging assay of the aqueous orange peel extracts against DPPH free radical was evaluated. Briefly, the extracts (50–200 µl) were diluted in 2ml of methanol and mixed with 1ml DPPH solution in order to obtain a final volume of 3ml solution. The reaction mixture was shaken and incubated in the dark. The absorbance of the solution was measured against a blank at 517 nm after 30 min. at room temperature.

Percentage inhibition of DPPH was calculated using the following equation:

% Inhibition = $[(A_0 - A_1)/A_0] \times 100$,

Where, A_0 is the absorbance of the blank and A_1 is the absorbance of the tested sample. Ascorbicacid was used as standard.

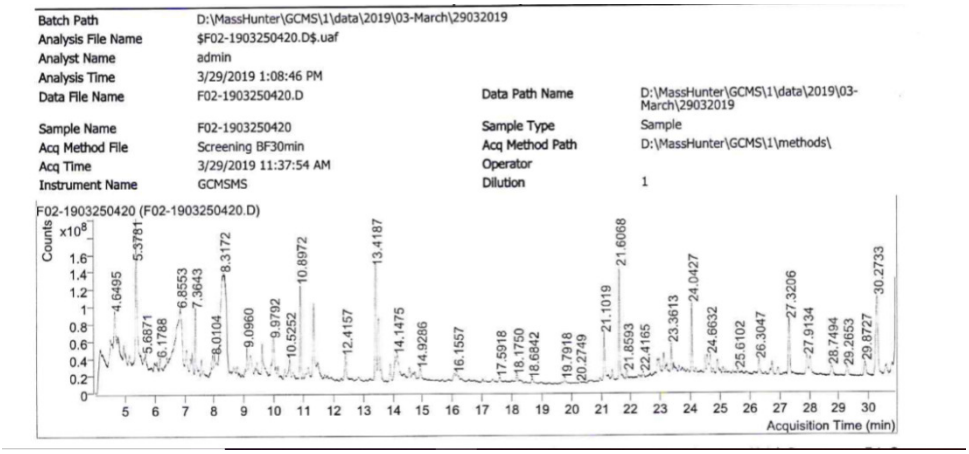
Results and Discussion

GCMS characterization of the methanol extracts of orange peel powder revealed the presence of methyl esters of fatty acids, phenolic compounds, vitamin E as the most predominant compounds as indicated in Table 1 and Fig. 1.

Table 1: Identified compounds in methanol extract of orange peel powder

S.No.	Compounds	Retention time (min)	Match score (%)
1.	Catechol	4.52	62.8
2.	Phenol,5-ethenyl-2-methoxy	5.38	84.3
3.	Benzene butanoic acid	6.18	62.8
4.	n-hexadecanoic acid	11.34	81.2
5.	Octadecanoic acid	23.11	67
6.	Vitamin E	27.32	63.3
7.	Gamma sitosterol	30.27	80.1

Fig. 1. GCMS characterization of orange peel powder



Several studies documented that hexane and dichloromethane were well known organic solvents for extracting nonpolar natural compounds from plant materials. In this study, orange peel was extracted with methanol and the identified compounds in the methanol extract were listed in the table, which were more or less similar to the findings of Erukainure *et al*., 2016 and the presence of vitamin E in this result agrees for the antioxidant activity of orange peel.

DPPH assay has been widely applied in several studies to evaluate antioxidant activities (Brand-Williams *et al.,* 1995). The anti-oxidant activity of orange peel powder extract

obtained was as follows. Free radical scavenging assay for different fractions of orange peelaqueous extracts against DPPH revealed 71.2 per cent activity when compared to the standard ascorbic acid which showed 92.5 per cent. The results obtained were in accordance with the findings of Singh and Immanuel, 2014 who reported the same in the aqueous extract of orange peel.

Conclusion

Recently natural antioxidants have gained considerable interest for their role in preventing the auto oxidation of fats, oils and fat containing food products. In addition, natural antioxidants are safe and impart health benefit to the consumers. Fruit peels like lemon, orange and pomegranate are normally wasted during fruit processing which are good sources of antioxidant polyphenols (Arora and Kaur, 2013). Synthetic antioxidants generally used in food products like BHT and BHA may cause health hazards. Thus, a proper waste utilization of fruit peels might prove to be a better substitute in place of synthetic antioxidants in extending the shelf life of food products.

Acknowledgment

We would like to thank Madras Veterinary College, TANUVAS, Chennai for providing the facilities and financial assistance to carry out this research work.

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