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EFFECT OF ORANGE ''*Citrus sinensis*'' PEEL FROM ALGERIA IN FOOD

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Abstract. Due to rapid growth of the food processing industry and the consumption of processed foods, the demand for natural antimicrobial agents is on the rise. Consumers have become more aware about the health effects of the synthetic preservatives used in food. Hence natural preservatives are developed to meet the demand of consumers. These natural antimicrobials are developed either from plants or their parts, animals or even microorganisms. Even the waste generated from the food industries is being considered as an alternative to produce natural antimicrobials. The aim of the present study was to utilize the waste generated from the citrus fruit processing (peel) industry. This study was to utilize the powder from the peel of *Citrus sinensis* in food (Oil of olive and cream dessert) to preserve their quality, this peel can be used as antimicrobial and antioxidant activity so food preservation purpose.
Keyword*: Citrus sinensis* peel, powder, food, antimicrobial activity, antioxidant activity.

Introduction

The genus *Citrus*, belonging to the Rutaceae or Rue family [LOUSSERT, 1989], comprises of about 140 genera and 1,300 species.

Citrus sinensis (Orange), *Citrus paradise* (Grapefruit), *Citrus limon* (Lemon), *Citrus reticulate* (tangerine), *Citrus grandis* (shaddock), *Citrus aurantium* (sour orange), *Citrus medica* (Citron), and *Citrus aurantifolia* (lime) are some important fruits of genus *Citrus.*

Citrus are well known as one of the world's major fruit crops that are produced in many countries with tropical or subtropical climate. Brazil, USA, Japan, China, Mexico, Pakistan, and countries of the Mediterranean region, are the major *Citrus* producers [CLEMENT, 1981].

Worldwide, *Citrus* production is estimated to be at levels as high as 105 million metric tons (MMT) per annum, Brazil being the largest producer with contribution of 19.2 MMT followed by the United States.

Pakistan with an annual production ca. 1.76 MMT of *Citrus* fruits stands among the ten top *Citrus* producing countries of the world.

Citrus fruits and their by–products are of high economic and medicinal value because of their multiple uses, such as in the food industry, cosmetics and folk medicine [BUTNARIU *et al.*, 2014].

In addition to large scale consumption as fresh fruits, the *Citrus* fruits are mainly processed to produce juice [BUTNARIU and GIUCHICI, 2011].

The waste of *Citrus* processing industry left after juice extraction, such as peels, seeds and pulps, corresponding to about 50 % of raw processed fruit, can be used as a potential source of valuable by–products.

Specifically, *Citrus* peels, commonly treated as agro–industrial waste, are a potential source of valuable secondary plant metabolites and essential oils [BUTNARIU *et al.*, 2012, PUTNOKY *et al.*, 2013].

The orange fruit is composed of an external layer (peel) formed by flavedo (epicarp or exocarp) and albedo (mesocarp), and an inner material called endocarp that contains vesicles with juice.

The seeds are usually embedded at centre of the fruit, in direct contact with the juice sacs [BOUHADI, 2000, BAGIU et al., 2012].

These health benefits are as a result of vitamins, especially vitamin C [HOFFMANN, 1971], phytochemical compounds like liminoids, synephrine, hesperidin flavonoid, polyphenols, pectin *etc*. [BUTNARIU

et al., 2016, BUTNARIU, 2012]. A single orange is said to have about 170 phytonutrients and over 60 flavonoids [GUIGNARD, 2000].

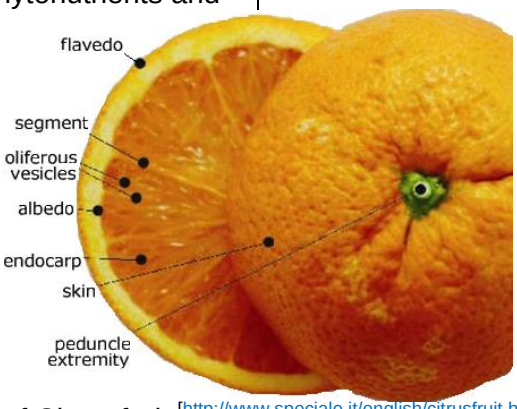

Figure 1. Structure of Citrus fruit [http://www.speciale.it/english/citrusfruit.html. accessed in 25/01/2016].

This study was to utilize the powder from the peel of *Citrus sinensis* in food (Oil of olive and cream dessert) to preserve their quality, this peel can be used as antimicrobial and antioxidant activity so food preservation purpose.

Material and methods

The study was conducted in the University of Mustapha Stambouli–Mascara–Algeria

Plant materials

Oranges (*Citrus sinensis*) were purchased from local market in February and March 2016.

Samples

Oil of olive and cream dessert

Preparation of Plant Materials

The peels were carefully washed under running tap water followed by sterile distilled water.

These were sun dried for seven days, pulverized to a fine powder using a manual grinder.

Preparation of samples of olive oil

For our analysis Carry on meeting in bottles of olive oil with doses of different powders, bottles are well closed and put in place non–opaque pendant 48 hours.

After the broadcast on UN thermal treatment wall–on Samples Nôtre, the temperatures Who are Chosen: 150°C, 200°C and 250°C pendant 30 minutes, NOS Samples obtained Cooled AND ARE undergo various physical analyzes–chimiques.

Preparation cream dessert

The custard is produced thick consistency June presenting OR LESS, made from pasteurized milk, sugar, cocoa, starch and gelling then adding powder orange peel

Results and discussion

The results are presented in tables (Table 1, 2, 3, 4, 5, 6 and 7)

Table 1.

Peroxide Index

Temperature (°C)	Samples	
	Witness	With powder of orange peel
150	15	8,5
200	6,5	08
250	5,5	06

Table 2.

Saponification Index

Temperature (°C)	Samples	
	Witness	With powder of orange peel
150	182,32	187,23
200	183,02	185,13
250	186,53	185,83

We notice that this index in the control increases with increasing temperature but the added sample Orange peel powder, saponification decreases with the increase of the treatment temperature.

Table 3.

Acid Index

Temperature (°C)	Samples	
	Witness	With powder of orange peel
150	0,44	1,24
200	0,96	1,48
250	2,28	1,72

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According to our results, the acid number augments prominently among samples when temperatures rise. This imperative means that olive oil does not remain insensitive to the possible hydrolysis of fats, including glycerides.

Table 4.

Total bacteria (CFU / Gx10^3)

Storage time (days)	Samples	
	Witness	With powder of orange peel
1st day	9	16
Day 7	10	04
Day 15	uncountable	52

Table 5.

Faecal germs (CFU / Gx10^3)

Storage time (days)	Samples	
	Witness	With powder of orange peel
1st day	00	00
Day 7	21	02
Day 15	66	70

Table 6.

Psychrotrophs (CFU / Gx10^3)

Storage time (days)	Samples	
	Witness	With powder of orange peel
1st day	02	00
Day 7	uncountable	63
Day 15	37	00

Table 7.

Yeasts and molds (UFC/Gx10^3)

Storage time (days)	Samples	
	Witness	With powder of orange peel
1st day	10	00
Day 7	10	10
Day 15	140	30

Absence of pathogens: *Staphylococcus aureus*, *Salmonella* and *Clostridium* sulfite reducers.

It appears that the heat treatment was effective and good hygiene Maintenance at the production line [APRIL, 1997]. The antimicrobial potency of plants is believed to be due to tannins [CHEFTEL, 1977], saponins, phenolic compounds, essential oils and flavonoids [DUPAIGNE, 1972, PETRACHE *et al.*, 2014]. These compounds are known to be biologically active and therefore aid the antimicrobial activities of the plants.

These secondary metabolites exert antimicrobial activity through different mechanisms.

Tannin as observed in *Citrus cinensis* peel extract have been found to form irreversible complexes with proline rich protein resulting in the inhibition of cell protein synthesis.

Citrus plants could be regarded as medicinal due to high level of flavonoid content in them [EZEABARA *et al.*, 2013].

A high quality orange is one that is mature with good color intensity uniformly distributed over the surface.

Such oranges must be firm with a fairly smooth texture and shape that is characteristic of the variety, free from decay, defects and other blemishes.

The biological activity and the healthy effects of citrus flavonoids as antioxidants have been reported.

These group of pigments as found in plants and together with anthocyanin play a role in flower and fruit colouration.

Also, they are present in dietary fruits and vegetable, and exercise their antioxidant activity in several ways, including the activities of metal chelation.

Studies indicate that flavonoids are excellent radical–scavengers of the hydroxyl radical, due to their to ability to inhibit the hydroxyl radical and donate hydrogen atom.

Oranges as excellent source of vitamin C [CHOI *et al.*, 2002] contain powerful natural antioxidant, folate, dietary fibre and other bioactive components, like carotenoids and flavonoids that prevent cancer and degenerative diseases.

Consumption of foods rich in vitamin C improves body immunity against infectious agents and scavenging harmful, pro–inflammatory free radicals from the blood. Sweet orange contains a variety of phytochemicals like hesperetin and narigenin. Naringenin has a bioactive effect on human health as antioxidant, free radical scavenger, anti–inflammatory, and immune system modulator [OIKEH *et al.*, 2013, BUTNARIU *et al.*, 2016].

Conclusions

The citrus peels are rich in nutrients and contain many phytochemicals with strong potential for use in drug production or as food supplements.

Our results are in agreement with these assertions as a range of phytochemicals viz; alkaloids, terpenoids, tannins, flavonoids, saponins, cardiac glycosides, steroids were detected in the orange peels and seeds extracts.

References

1. Avril, J.L. Nouveau dictionnaire de bactériologie clinique. Edition Ellipses. **1997**.
2. Bagiu, R.V.; Vlaicu, B.; Butnariu, M. Chemical Composition and in Vitro Antifungal Activity Screening of the *Allium ursinum* L. (Liliaceae), *International journal of molecular sciences*, *2012*, 13(2), 1426–1436.
3. Bouhadi, Elaboration et l'étude de la qualité d'un nouveau type coupe ''Carotte–Orange'' et essai de conservation. Mémoire de fin d'étude en vue de l'obtention de diplôme d'ingénieur. *Université de Mascara, Algérie*. **2000**.
4. Butnariu, M. An analysis of *Sorghum halepense's* behavior in presence of tropane alkaloids from *Datura stramonium* extracts, *Chemistry central journal*, **2012**, Volume: 6, Article Number: 75.
5. Butnariu, M.; Caunii, A.; Putnoky, S. Reverse phase chromatographic behaviour of major components in *Capsicum Annuum* extract, *Chemistry central journal*, **2012**, Volume: 6, Article Number: 146.
6. Butnariu, M.; Rodino, S.; Petrache, P.; Negoescu, C.; Butu, M. Determination and quantification of maize zeaxanthin stability, *Digest journal of nanomaterials and biostructures*, **2014**, 9(2), 745–755.
7. Butnariu, M.; Sarac, I.; Pentea, M.; Samfira, Ionel.; Negrea, A.; Motoc, M.; Buzatu, A.R.; Ciopec, M. Approach for Analyse Stability of Lutein from *Tropaeolum majus*. *Revista de chimie*, **2016**, 67(3), 503–506.
8. Butnariu, M.; Smuleac, A.; Dehelean, C.; Chirita, R.; Saratean, V. Studies concerning fertilizer influence (NPK in different doses) on quantity of corn plants chlorophyll, *Revista de chimie*, **2006**, 57(11), 1138–1143.
9. Butnariu, M.V.; Giuchici, C.V. The use of some nanoemulsions based on aqueous propolis and lycopene extract in the skin's protective mechanisms against UVA radiation, *Journal of nanobiotechnology*, **2011**, Volume: 9, Article Number: 3.
10. Cheftel, J–C.; Cheftel, H.; Besancom, P. Introduction à la biochimie et la technologie des aliments. **1977**.
11. Choi, M.H.; Kim, G.H.; Lee, H.S. Effects of ascorbic acid retention on juice color and pigment stability in blood orange (*Citrus sinensis*) juice during refrigerated storage. *Food Research International*; **2002**, 35(8): 753–759.
12. Clement, M. La Fleur de lotus, **1981**.
13. Dupaigne, P. Les boissons des fruits, preparation conservation. *Conseil International de la Langue Francaise, 75–Paris fre 35621* **1972**.
14. Ezeabara, C.A.; Okeke, C.U.; Aziagba, B.O. Flavonoid Content of *Citrus* Species Grown in Awka, Anambra State, Southeastern Nigeria Aziagba. *International Journal of Agriculture and Biosciences*. **2013**, 2(3):103–107.
15. Guignard, J-L. Biochimie végétale; Paris. **2000**.
16. Hoffman, D.W.; The assessment of soil productivity for agriculture, University of Guelph, 1971.
17. http://www.speciale.it/english/citrusfruit.html accessed in 25/09/2016
18. Loussert, R. Les Agrumes, Volume 2 Production; ÉDITIONS TEC ET DOC / LAVOISIER. 1989.
19. Oikeh, E.I.; Oriakhi, K.; Omoregie, E.S. Proximate Analysis and Phytochemical Screening of *Citrus sinensis* Fruit Wastes. *The Bioscientist*. **2013**.1(2):164–170.
20. Petrache, P.; Rodino, S.; Butu, M.; Pribac, G.; Pentea, M.; Butnariu, M. Polyacetylene and carotenes from *Petroselinum sativum* root, *Digest journal of nanomaterials and biostructures*, **2014**, 9(4), 1523–1527.
21. Putnoky, S.; Caunii, A.; Butnariu, M. Study on the stability and antioxidant effect of the *Allium ursinum* watery extract, *Chemistry central journal*, **2013**, Volume: 7, Article Number: 21.

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