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Pomegranate Peels: Source of Antioxidants Extraction and Natural Dentifrices Preparation

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Abstract:

The problem of pollution with agricultural waste is representing one of the permanent environmental problems because of the large amount of waste poses from one hand and continuation poses of these wastes to environment year-around on the other hand. This research aims to try to resolve this problem through the realization of maximum benefit from pomegranate (Punica granatum) peels as agricultural wastes by extraction of antioxidants (phenolics) using including water as a natural solvent at different operating conditions of (water/waste) ratio, extraction temperature and time of extraction process. After that natural toothpaste has been prepared from the waste of pomegranate peel residue remaining from antioxidants extraction process by mixing it with some other natural substances. The results show that the maximum yield of antioxidants (phenolics) produced was 20.15% at (water/waste) ratio, extraction temperature and time of extraction process of 20:1, 45°C and 300 minute respectively. The results also illustrate that the toothpaste gives whiter for teeth higher than the ordinary toothpaste. Thus, it has been eliminate of pomegranate peel in a meaningful, economic and eco-friendly way.

Key words: Pomegranate peel, antioxidants, phenolics, toothpaste, Zero Residue level

1. Introduction

The environment suffers from many problems since human presence on the surface of earth. As a result of increasing the number of population, growing the requirements of their lives and the diversity of their needs from food, clothing, housing, education, health, transportation, entertainment and other with passage of time and progress of living, the environmental problems are increased and aggravated dramatically in all respects (Abbas and Abbas, 2013 a). The putting solutions are no longer commensurate with the problems diversity that experienced by the environment, which are ranging from depletion of resources, natural disasters, climate change to the endangered species and all these problems, the human were the main reason or one reasons of occurrence. The most important and complex of these problems is pollution problem (Abbas and Abbas, 2013 b). Pollution can be defined as any direct or indirect change leads to damage with the basic elements of environment: water, air, soil and organisms or upset the natural balance of the ecosystem compounds or adversely affect on the practice of normal human life (Abbas and Abbas, 2013 c). Because of the continuous change in human life, and his continuing desire to improve, the pollution takes different kinds due to the size and types of wastes poses by human (Abbas and Abbas, 2013 d).

There are bio-contamination with microbes, viruses, bacteria, fungus and etc.; chemical contamination with pesticides, heavy metals, dyes, toxics and hospital wastes; thermal contaminant with the power plants effluents (Abbas and Abbas, 2013 e)and radioactive contamination with radioactive elements and materials results from using nuclear energy and atomic weapons testing (Abbas, 2013). Beside of all above types of pollution there is another type which considered as lower harmful types of pollution on the environment but covers a very wide area of earth land; it is agricultural waste

contamination which results from the launch of various kinds of agricultural waste to environment (Abbas, 2013), (Abbas and Abbas, 2013 a), (Abbas and Abbas, 2013 b), (Abbas and Abbas, 2013 c), (Abbas and Abbas, 2013 d) and (Abbas and Abbas, 2013 e). One of the methods that currently tracking to solve this problem is trying to benefit from these wastes, where the most of agricultural wastes are materials can be exploited in production, synthesis, preparation and extraction of many useful substances which can eradicated the pollution and also provide required substances from non-valuable resources (Abbas and Abbas, 2014 a) (Abbas and Abbas, 2014 b), (Abbas et. al., 2013 a), (Abbas et. al., 2013 b) and (Abbas et. al., 2014).

Pomegranate peels are one of the agricultural wastes which pose to the environment in huge amounts around the world from canning plants, juice production and food processing. Pomegranate peels are possessing verity of elements and substances such as protective agents, antimicrobial, enzymes and antioxidants which can obtained them and utilized from the residue in many easy and simple ways. Oxygen is a vital substance for living cells which they using it in metabolism process for fats, proteins, and carbohydrates to produce energy required for survival. While oxygen considered as one of the most basic elements to live, it is also considered as a double edged sword due to its high ability to produced damaging molecules namely “free radicals”. Free radicals have ability to attack the sound body cells causing damage, disease and severe disorders like aging, decline in brain function, decline in immune system, oxidative damage to DNA, proteins, and other macromolecules which may lead to a wide range of human diseases such as heart disease and cancer. The formation of free radicals may be made due to several environmental factors such as alcohol, medications, infections, poor diet, toxins, radiation, exposure to pollutants, etc. and can be controlled naturally by several useful molecules called antioxidants. Antioxidants are qualified for stabilizing and/or

deactivating free radicals molecules before they attack cells. Many nutrients in food contain antioxidants like vitamin C, vitamin E, and beta carotene.

Another source of antioxidants is fruit peels especially pomegranate peels which considered as a type of agricultural waste and available in huge amounts (Mandal, 2013). The aim of this paper is exploitation from pomegranate peels to extract antioxidant has many uses in chemical and medical fields and benefit from the residue to produce natural, homemade and cheap toothpaste and does not containing any chemicals. By this way it was getting rid of pomegranate peels in economical, useful and eco-friendly method.

2. Materials and Method

Pomegranate peels were obtained freely from the juice shops at local markets in Baghdad, Iraq.

2.1 Antioxidant Extraction

The yield of antioxidant compounds (phenolics) that extracted from agricultural substances (wastes or fruits or plants) is a liquid-solid extraction process performed to insulate a liquid part soluble in porous solid and affected fundamentally with operating some conditions. In this study the extraction process is achieved using deionized water as a solvent only (Wang *et. al.*, 2011).

2.1.1 Antioxidant Extraction Procedure

Fresh pomegranate peels were dried in sunlight for 24 hours, mixed with double distilled deionized water in a Laboratory Digital Thermostatic Shaking Water Bath (SHA-C, JY, Jintan Medical Instrument Factory, Changzhou, China) at a water/peel ratio, temperature and shaking time ranged between 10:1 to 20:1 (w/w) (dry weight), (20-45°C) and (3-300 min) respectively to find the best operating conditions for

antioxidant extraction from pomegranate peels. The extracted mixture obtained was filtered to separate the solid content from the required antioxidant by vacuum filtration via Whatman® filter paper No. 1. The separated filtrate was dried by air at room temperature in hood and further dried was conducted in a vacuum oven at 50±2 °C to remove moisture residue. The final extract was analyzed to detect the total yield content of antioxidant substances including phenolics, and flavonoids.

2.1.2 Total Phenolics Content Determination

The determined of total phenolics content in the pomegranate peels extracted solution was performed by the Folin-Ciocalteu method (Sahu and Saxena, 2013).

2.1.2.1 Preparation of Folin-Ciocalteu's Phenol Reagent

10 g of sodium tungstate (Na_2WO_4) and 2.5 g of sodium molibedate (Na_2MoO_4) were dissolving in 70 ml of deionized water in a 100 ml conical flask. 5 ml of 85% of phosphoric acid (H_3PO_4) and 10 ml of concentrated hydrochloric acid (HCl) were adding to above mixture and refluxing for 10 hours. After cooling, 15 g of lithium sulfate (Li_2SO_4), 5 ml of deionized water and 1 drop of bromine water (1.1 g sodium bromide (NaBr), 10.7 ml 1 M (HCl), 7.6 ml sodium hypochlorite (NaClO) and 32 ml deionized water) were adding and the solution was allowed to reflux for 15 minutes. Then cooled at room temperature and bring to 150 ml water. The produced reagent has clear bright yellow solution (Li *et. al.*, 2006).

2.1.2.2 Total Phenolics Content Determination Procedure

The amount of total phenolics in extracts was determined with the Folin-Ciocalteu reagent. Gallic acid was used as a standard and the total phenolics were expressed as mg/g gallic acid equivalents (GAE). Concentration of 0.01, 0.02, 0.03, 0.04 and 0.05 mg/ml of gallic acid were prepared in methanol. Concentration of 0.1 and 1 mg/ml of plant extract were also

prepared in methanol and 0.5ml of each sample were introduced into test tubes and mixed with 2.5 ml of a 10 fold dilute Folin-Ciocalteu reagent and 2 ml of 7.5% sodium carbonate. The tubes were covered with parafilm and allowed to stand for 30 minutes at room temperature before the absorbance was at read at 760 nm spectrometrically. All determination was performed in triplicate.

The Folin-Ciocalteu reagent is sensitive to reducing compounds including polyphenols, thereby producing a blue colour upon reaction. This blue colour is measured spectrophotometrically. Thus total phenolic content can be determined (Maurya and Singh, 2010) using a gallic acid standard curve shown in Figure 1.

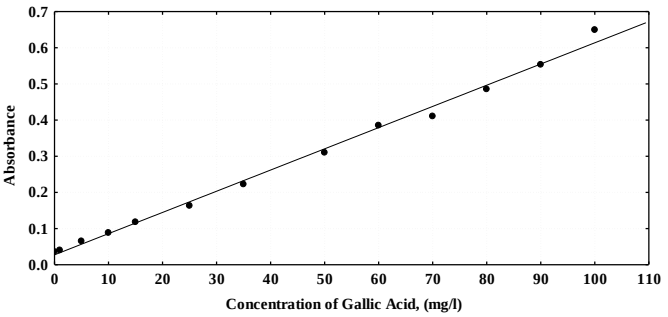

Figure 1 Calibration curve of standard Gallic acid analyzed by spectrophotometer

2.2 Preparation of Natural Toothpaste

The wastes residue of pomegranate peel from antioxidant extraction in section 2.1 were collected and washed carefully with dropped double distilled water and prepare for the second step which was producing natural toothpaste. 35% of pomegranate peels residues were mixed 35% with removed thorns Cactuses (aloe vera), 10% baking soda, 3.5% cloves flower leaves, 5% fresh peppermint, 4% pure water, 2% anise, 1% strawberries, olive, cinnamon, 0.5% orange juice, crushed twig (siwak), coconut oil, salt and rose water. All above

ingredients were mixed with blender carefully until obtain a thick paste.

3. Results and Discussion

3.1 Antioxidant Extraction

3.1.1. Effect of (Water/Waste) Ratio

The results elucidated that when the (water/waste) ratio in extraction process was increased, the yield of antioxidant compounds (phenolics) yield was increased too at as shown in Figure 2. The increased of (water/waste) ratio meaning increased in the amount of water solvent of course with constant the waste mass (pomegranate peels), thus increasing the solvent (water) volume has the ability to extract further number of antioxidant compounds (phenolics) molecules. This lead to increase the ability of producing additional amount of phenolics and ultimately the yield of antioxidant compounds increased.

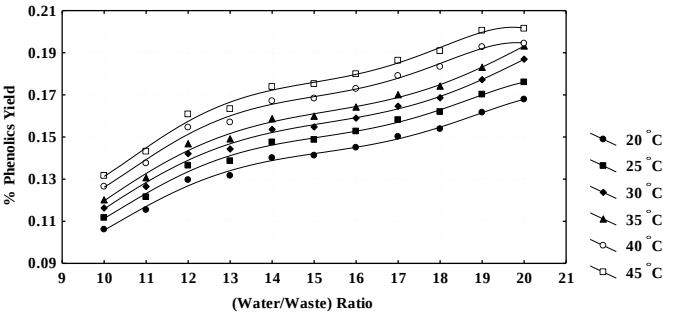

Figure 2 Effect of (Water/Waste) Ratio on % Phenolics Yield

3.1.2. Effect of Extraction Temperature

The results illustrated that when the extraction temperature was increased, the yield of antioxidant compounds (phenolics) yield was increased too at as shown in Figure 3. In general, the diffusion coefficient and solubility of any compounds, e.g. antioxidant compounds (phenolics) are highly influenced by the

ambient temperature of process for instance the extraction process. Because of that, the increase in extraction temperature lead to affected the extract mass transfer velocity and due to that the diffusivity of phenolic compounds in the waste (pomegranate peels) influenced strongly, so the total phenolics yields increases significantly.

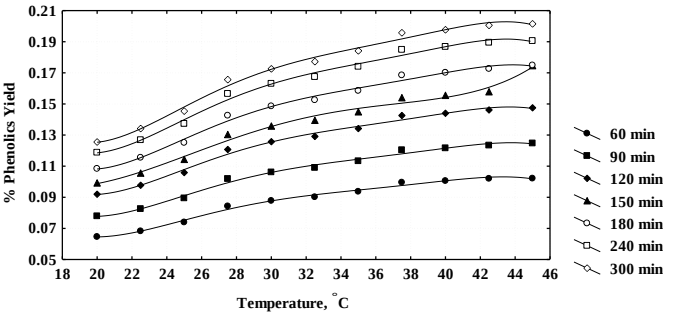

Figure 3 Effect of Temperature on % Phenolics Yield

3.1.3. Effect of Extraction Time

The results showed that when the time of extraction was increased, the yield of antioxidant compounds (phenolics) produced was increased too in the range (3-300 min) as shown in Figure 4. The extraction process is influenced by time (until reach equilibrium) and it may be due to the fact that when the extraction time increasing and the mass of waste (pomegranate peels) was remaining constant, the peels spend longer time during extraction process, i.e. the extraction process take additional time and can extract more molecules of phenolics, so the extraction can produce more amount of phenolics from the same mass of peels, therefore the yield of antioxidant compounds (phenolics) yield from pomegranate peels waste was increased.

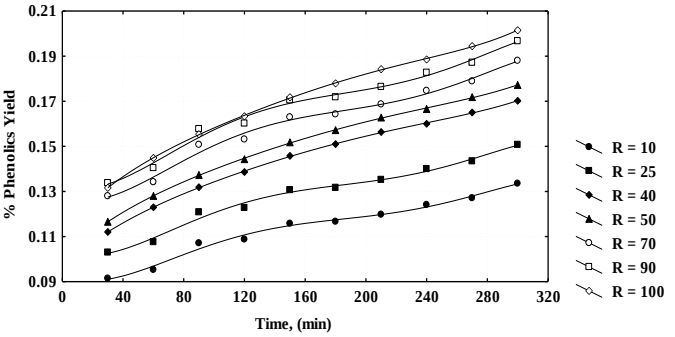

Figure 4 Effect of Time on % Phenolics Yield

3.2. Preparation of Natural Toothpaste

Utilization from these pomegranate peels waste residue can be achieved by using it as a raw material for natural toothpaste preparation as follows: pomegranate peels waste which was remaining after using it in extraction antioxidant compounds (phenolics) were washed with pure water, leaving at sunlight until dried and utilization from them as a raw material for natural toothpaste preparation. Toothpaste prepared show fragrant scent and gave good tooth whitening when brushing with it than tooth brushing with other traditional toothpaste, moreover this toothpaste contains natural elements maintain the health of the gums and protect teeth from plaque, tartar and cavities. It's known that the dentifrice is a paste contains active elements that maintain the natural health of the gums (gingiva) and protect teeth from plaque, stains, tartar and cavities. These elements are abrasives, fluorides, desensitizing agents, antiplaque agents, antitartar, detergents, humectants, thickeners, preservatives, flavouring agents, sweeteners, and colouring agents.

All these ingredients of toothpaste were replaced with natural substances trying to prepare natural toothpaste homemade, cheap and healthy using pomegranate peels residue. Pomegranate peels residue play the role of abrasive agent and whitening effect together with baking soda for removing the broad base of stains that are deposited on the

tooth and due to the pomegranate peels residue as a natural abrasive agent the toothpaste gave its properties of whitening because the primary purpose of the abrasive particle is to remove plaque from the teeth and to remove stains from the tooth surfaces.

4. Conclusions

The following conclusions can be drawn:

1. It is possible to exploit the pomegranate peels with easy, simplest and economical methods to extract benefit substance which is antioxidant compounds (phenolics).
2. Maximum yield production of phenolics was (20.15%) using extraction procedure of fresh pomegranate peels using water as natural solvent at (water/waste) ratio, extraction temperature and time of extraction process of 20:1, 45°C and 300 minute respectively.
3. It can be prepared good toothpaste from the residue remaining of pomegranate peels that used in the extraction of antioxidant compounds (phenolics).

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