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Nutritional and functional properties of some by-products of dehydrated food companies

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Abstract: The processing of plant foods results in the production of by-products that are rich sources of bioactive compounds. In the present study, nutritional and functional properties of some by-products of dehydrated food processing companies were determined. Data of the proximate chemical composition of the selected by-products including red onion skin powder (ROSP), white onion skin powder (WOSP) and potato peel powder (PPP) showed that the moisture content was ranged 6.04 -8.21 %, total protein was 2.41-10.88%, crude fat was 1.65-8.87%, crude fiber was 10.94 - 28.65%, ash content was 4.52 - 6.88% and total carbohydrate content was 45.01- 65.97%. The PPP was recorded the highest content of protein while WOSP recorded the highest values of crude fat, crude fiber and ash. Total dietary fiber, carotenoids and phenolics contents of the by-products was ranged 46.78 - 62.18 $g.100g^{-1}$, 81.32 -101.19 $mg.100g^{-1}$ and 1087- 9287mg EGA.100 g^{-1}, respectively. The ROSP was recorded the highest content of total dietary fiber, total carotenoids and total phenolics. Antioxidant evaluation, hydroperoxide formation in sunflower oil-in-water emulsions, of the tested by-products showed considerable activity for PPP while strong activities for the onion skin powders. Regarding to this property, the all tested by-products could be arranged as follow: ROSP> WOSP> PPP. In conclusion, new aspects reported in the present study, the use of these wastes as by-products for further exploitation on the production of food additives have gained increasing interest because these are high-value products and their recovery may be economically attractive.

Keywords: Onion skin, potato peel, carotenoids, dietary fiber, phenolics, antioxidant evaluation.

Introduction

Phytochemicals, which are non-nutritive plant chemicals, constitute a heterogeneous group of substances. Recently, it is clearly known that they have roles in the protection of human health, when their dietary intake is significant. These compounds are known have many biological properties such as antioxidant activity, antimicrobial effect, modulation of detoxification enzymes, stimulation of the immune system, decrease of platelet aggregation and modulation of hormone metabolism and anticancer property (Elhassaneen and Abd Elhady, 2014 and Shalaby, 2015). There are more than thousand known and many unknown phytochemicals. It is well-known that plants produce these chemicals to protect themselves, but recent researches demonstrate that many phytochemicals can also protect human against diseases. Because of this property, many researches have been performed to reveal the beneficial health effects of phytochemicals (Shalaby, 2015). Others its most important property i.e. antioxidant activity in many food technological applications (Serag El-Din, 2001; Schieber *et al.,* 2001; Dewan, 2004, Altiok, 2008; Mohamed, 2011 and Mosa, 2014).

The processing of plant foods results in the production of by-products that are rich sources of bioactive compounds, including phenolic compounds (Altiok, 2003 and El-Wazeer, 2011). By-products of plant food processing represent a major disposal problem for the industry concerned, but they are also promising sources of compounds which may be used because of their favorable properties. Industrialization of agriculture in the Arab world represent a large proportion of waste was estimated at 18.14 million tones per year and represent remnants of fruit and vegetables manufacture about 6.14% of this amount (http://elasaala.blogspot.com/2012/01/blog-post_2703.html). Waste in the food industry is characterized by a high ratio of product-specific waste. This not only means that the generation of this waste is unavoidable, but also that the amount and kind of waste produced, which consists primarily of the organic residue of processed raw materials, can scarcely be altered if the quality of the finished product is to remain consistent. The utilization and disposal of product specific waste is difficult, due to its inadequate biological stability, its potentially pathogenic nature, its high water content, its potential for rapid autoxidation, as well as its high level of enzymatic activity. The diverse types of waste generated by various branches of the food industry can be quantified based upon each branches' respective level of production.

Onions (*Allium cepa* L.) are the second most important horticultural crop worldwide, after tomatoes, with current annual production around 66 million tonnes. Over the past 10 years, onion production has increased by more than 25% (FAO, 2008). Raw and cooked onions are consumed as young green plants or as bulbs. They are valued for their distinctive pungency and flavour which improve the taste of other foods. Onion either green or bulbs are used almost daily in every home and are essential ingredient in Nigerian diet (NIHORT, 1986). In some rural parts of northern Nigeria, dried fermented preparations from green leaves are used to flavour foods when fresh onions are not available. Large amount of onion wastes are produced by consumption of onion both domestically and industrially, making it necessary to search for their utilization. These wastes get decayed and add themselves to the soil causing odor and in some cases causing harm to the environment. The main onion waste include onion skins, two outer fleshy scales and roots generated during industrial peeling and undersized malformed or damaged bulbs (Benitez *et al*., 2011). These wastes represent an environmental problem since onions wastes are not suitable for fodder in high concentration due to onion characteristic aroma and neither as an inorganic fertilizer because of the rapid development of phytogenetic agents (Waldron, 2001). Recent development has also shown that dogs, cats, guinea pigs and other animals should not be given onions in any form due to toxicity during digestion (Salgado *et al*., 2011). Hence there is a need to find other use for onion wastes. Several work had been done on onion wastes to gain knowledge of their dietary fiber component, sulphur content and phenolic content (Benitez *et al.*, 2011 and Ahmed, 2015).) but reports are scanty on the nutritive mineral elements and fatty acids profile of the oil.

Potato (*Solanum tuberosum* L.) is the largest vegetable crop worldwide, amounting to approximately 320 million metric tons annually (FAO, 2005). Processing of potatoes (mainly for the production of chips, French fries, and dehydrated products) has presented a steady increase during the last decades, exceeding considerably the amount of the vegetable consumed as fresh (Kadam *et al.*, 1991; Schieber *et al.*, 2001). Solid waste generated during processing consists mostly of potato peels but also contains green, immature, and cull potatoes and amounts to 15–45% depending on the procedure applied (Schieber *et al.*, 2001). It is used as animal feed, though fermentation for the production of single cell or alcohol has been considered (Natu *et al.*, 1991). Water from potato processing is used for the recovery of proteins by heat coagulation (Natu et al., 1991). Recent investigations suggested the use of water extracts from potato processing waste for the recovery of antioxidants (Rodriguez de Sotillo *et al.*, 1994).

Deep-fat frying represents an important method of food preparation of daily dishes in different countries including Egypt, either in home or in restaurants. During deep-fat frying, many physical and chemical changes occur in the frying oil that may adversely affect nutritional value and sanitation of foods. These changes include three general chemical reactions that may occur simultaneously: hydrolysis, polymerization and oxidation, which produce a great number of potential toxic decomposition products deposit on the surface of the fryer and adsorbed by the food (Pamela, 1991; Arroyo *et al*., 1992; Cuesta *et al*., 1993; Rabie and Hassan, 1996; and Elhassaneen and Shaheen, 1998). Also, interest in the effect of malonaldehyde, one of the major products of the oxidation of polyunsaturated fatty acids, on human health has been reported by many authors that is mutagenic and carcinogenic (Shamberger *et al*.,1974 and Mukia and Goldstein, 1976). The mutagenicity of malonaldehyde has been demonstrated by the Ames *Salmonella* revertant procedure (Shamberger *et al*., 1979) while its carcinogenicity was observed when painted on the skin of mice (Shamberger *et al*., 1974).

Although, many studies have been carried out to analyze these parts of the selected vegetables and fruit and introducing in different nutritional and nutraceutical applications but more and more research are still needed. Therefore, the objective of this work is to analyze some plant by-products including onions and potatoes peels that constitute to waste for their nutraceutical values as food ingredient thus reducing its contribution to environmental pollution. Also, utilization of such by-products for their high contents of bioactive compounds in many food technological applications will be in the scope of this study.

Materials and Methods

Materials

Onion skins, rad and white, were obtained from the New Beni Suef company for Preservation, dehydration and Industrialization of Vegetables, Beni Suef Elgudida City, Nile East, Beni Suef, Egypt; potato peel (PP) from SFCO For Manufacturing & Export Agricultural Products, El Negila, Kom Hamada, Behira Government , Egypt. Phenolic standars and α-tocopherol were purchased from Sigma -Aldrich Chemical Co agent, Egypt. All other chemicals and solvents were of analytical Grade and purchased from AlGhomhoria Co for Drugs, Chemicals and Medical Instruments, Cairo, Egypt.

Methods

Preparation of food by-products peel powder

Onion skins and potato peel were washed and then dried in a hot air oven (Horizontal Forced Air Drier, Proctor and Schwartz Inc., Philadelphia, PA) at 55 ^{0}C untill 6% mosture content. The dried peels were ground into a fine powder in high mixer speed (Moulinex Egypt, Al-Araby Co., Egypt). The material that passed through an 80 mesh sieve was retained for use.

Determination of chemical properties

Moisture, protein (T.N. x 6.25, Micro-Kjeldahl method), Fat (Soxhelt appratus, petrolium ether solvent) and ash contents were determined using the methods described in the A.O.A.C. (1990). Total soluble fiber was obtained by subtraction of contents of moisture, total lipids, ash and protein from 100.

Water (WHC) and oil (OHC) holding capacity

Water (WHC) and oil (OHC) holding capacity were determined according to the method of Larrauri *et al.*, (1996). Twenty-five milliliters of distilled water or commercial corn oil were added to 0.5 g of MPP or MKP, shacked vigorously for 1 min and then centrifuged for 15 min at 10,000g. The residue was weighed and the WHC and OHC were calculated as g water or oil per g of dry sample, respectively.

Determination of carotenoids and total dietary fiber

Carotenoids and Total dietary fiber in MPP and biscuits samples were analyzed as follow: MTT was extracted with 80% acetone and centrifuged at 10,000g for 15 min. For biscuits samples, one gram of biscuit powder was extracted with 20 ml of 80% acetone and centrifuged at 8000g at room temperature. The supernatant obtained from both samples were used for the analysis of total phenolics, carotenoids and antioxidant activity. The total carotenoids in 80% acetone extract were determined by using the method reported by Litchenthaler (1987). Total dietary fiber content in the MPP was estimated according to the method described by Asp et al. (1983).

Determination of total phenolics

One gram of ROSP and PPP were extracted with 80% aqueous methanol (25 ml) on an orbital shaker for 120 min at 70 ^{0}C. The mixture was subsequently filtered (Whatman No. 5) on a Buchner funnel, and the filtrate was assayed for antioxidant activity. Total phenolics were determined using Folin-Ciocalteu reagent (Singleton and Rossi, 1965). Two hundred milligrams of the tested sample was extracted for 2 h with 2 mL of 80% MeOH containing 1% hydrochloric acid at room temperature on an orbital shaker set at 200 rpm. The mixture was centrifuged at 1000g for 15 min and the supernatant decanted into 4 mL vials. The pellets were combined and used for total phenolics assay. One hundred microliters of the obtained extract was mixed with 0.75 mL of Folin-Ciocalteu reagent (previously diluted 10-fold with distilled water) and allowed to stand at 22 ^{0}C for 5 min; 0.75 ml of sodium bicarbonate (60 g/L) solution was added to the mixture after 90 min at 22 ^{0}C, absorbance was measured at 725 nm. Results are expressed as ferulic and equivalents.

Antioxidant evaluation in oil-in-water emulsion

Oil in water emulsions were prepared with 1% of Tween 20 emulsifier and 10% of sunflower oil, previously filtered through alumina column, as described by Yoshida (1993), in order to remove the tocopherols. The oil was added dropwise to the aqueous samples containing emulsifier cooled in an ice-bath, while sonicating for 5 min in total. Freeze-dried powder of both kinds of samples were added directly to the emulsion and homogenized, obtaining final concentration of 10, 20 and 30 mg/ml. For control, no sample was added. All emulsions were stored in triplicate in 25 ml amber bottles in the dark and allowed to oxidize at 40 ^{0}C. Peroxide value (PV) was measured periodically using aliquots of 0.005-0.1 g of each sample and determined by the ferric thiocyanate method (Frankel, 1998), after calibrating the procedure with a series of oxidized oil samples analyzed by the AOCS Official Method Cd 8-53.

Statistical Analysis

All measurements were done in triplicate and recorded as mean±SD. Statistical analysis was performed with the Student t-test and MINITAB 12 computer program (Minitab Inc., State College, PA).

Results and discussion

Chemical analyses of food by-products

The proximate composition of food by-products is shown in table (1). The results showed that the moisture content was ranged 6.04 - 8.21 %, total protein was 2.41-10.88%, crude fat was 1.65-8.87%, crude fiber was 10.94 - 28.65%, ash content was 4.52 - 6.88% and total carbohydrate content was 45.01- 65.97%. The PPP was recorded the highest content of protein while WOSP recorded the highest values of crude fat, crude fiber and ash. The proximate composition of ROSP and PPP reported was accordance with that observed by Ahmed (2015). In potato peel, Hanan, (2006) found that the chemical composition of dried potato peels were ash, 9.42%; total protein, 9.2%; total dietary fiber, 11.7%; fat**,** 0.1% and total carbohydrate, 11.7%. Regarding the onion skin, there is a dearth of information related to its chemical composition which make the comparison and confirmation the present data is relatively difficult. Data of the present study with the others confirmed that such tested by-product could be used successfully in food technology application due to their high nutritional value, good sources for protein, fiber and ash.

Table 1. Proximate chemical composition ($g.100g^{-1}$) of food by-products

Parameters	ROSP	WOSP	PPP
Moisture	8.21 ± 0.32	7.58 ± 0.41	6.04 ± 0.14
Total protein	2.41 ± 0.11	3.01 ± 0.09	10.88 ± 1.08
Crude fat	7.85 ± 1.05	8.87 ± 0.96	1.65 ± 0.12
Crude fiber	24.89 ± 2.03	28.65 ± 1.33	10.94 ± 0.91
Ash	5.99 ± 0.51	6.88 ± 0.37	4.52 ± 0.41
Carbohydrates	50.65 ± 2.89	45.01 ± 3.12	65.97 ± 6.55

* Each value represents the mean of three replicates ±SD.

Physical properties of food by-products

The water (WHO) and oil (OHC) holding capacity of food by-products were tabulated in table (2). From such data it could be noticed that WOSP recorded the highest WHO (11.95) followed by ROSP and PPP being 11.07 and 9.21 g $water.g^{-1}$, respectively, indicating that the higher fiber content in onion skins hold more water compared to PPP by-product. The present data are in accordance with that obtained by Ahmed (2015) who found that onion skin powder was higher than that of mango peel powder due to the higher fiber content in onion peel powder hold more water compared to mango peel powder. Also, this observation is agreed with those reported by Abdalla *et al.* (2007) and Ajila *et al.*, (2010).

Table 2. Physical properties of food by-products

Parameters	ROSP	WOSP	PPP
Water holding capacity (WHC, g $H_2O.g^{-1}$)	11.07 ± 0.98	11.95 ± 0.87	9.21 ± 0.45
Oil holding capacity (OHC, g $oil.g^{-1}$)	3.03 ± 0.11	4.82 ± 0.19	2.40 ± 0.07

* Each value represents the mean of three replicates ±SD.

Total dietary fiber, carotenoids and phenolics content of food by-products

Total dietary fiber and carotenoids and phenolics contents of food by-products are shown in table (3). The results showed that the total dietary fiber content was ranged 46.78 - 62.18 $g.100g^{-1}$, total carotenoids was 81.32 -101.19 $mg.100g^{-1}$ and total phenolics was 1087- 9287mg

EGA.100 g^{-1}. The ROSP was recorded the highest content of total dietary fiber, total carotenoids and total phenolics. Such data confirmed that such tested by-product could be constituted central position in nutritional/ pharmacetical applications through their high content of bioactive compounds. In similar studies, Ajila *et al.,* (2007 and 2010) found that carotenoids and dietary fiber contents in raw and ripe peels of Raspuri and Badami mango varieties, which ranged from 387 to 3337 mg/g and 44 to78%, respectively. Thus, total carotenoid and soluble dietary fiber contents determined in the present study were higher than that reported by the others. Such as reviewed in Al-Weshahy and Rao (2012) dietary fiber is well known as a bulking agent, increasing the intestinal mobility and hydration of the feces. Several authors have reviewed the importance of consumption of moderate amounts of dietary fibers for human health (Forsythe *et al.*, 1976 and Ballesteros *et al.*, 2001). Scientifically speaking, dietary fiber is a broad term that includes several carbohydrates; cellulose, hemicelluloses, lignins, pectins, gums etc (Gallaher and Schneeman, 2001). Camire *et al*., (1993) reported that potato peel fibers are primarily insoluble, and can bind bile acids *in-vitro*. It is believed that binding of bile acids is one of the mechanisms whereby certain sources of dietary fibers lower plasma cholesterol. It is reviewed by Schieber *et al.,* (2008) that the hypocholesterolemic effect

Table 3. Total dietary fiber, carotenoids and phenolics contents of food by-products

Parameters	ROSP	WOSP	PPP
Total dietary fiber (g.100g^{-1})	60.55 ± 2.17	62.18± 1.77	46.78 ± 1.66
Total carotenoids (mg.100g^{-1})	92.76 ± 5.89	81.32 ± 6.76	101.19 ± 2.54
Total phenolics (mg of GAE.100g^{-1} dw)	9287±421	4165± 213	1087± 65

* Each value represents the mean of three replicates ±SD.

of dietary fiber from PP and found that after four weeks of feeding on potato peels, rats showed 40 % reduction in plasma cholesterol content and 30% of hepatic fat cholesterol levels were reduced as compared with animals fed only with cellulose supplemented diet. Defects of dietary fiber on lipid-profile influence several health related issues. High concentrations of low-density lipoprotein (LDL) cholesterol, other dyslipidemia (high concentration of triglycerides and low concentration of high-density lipoprotein [HDL] cholesterol), leads to blood platelets aggregation (Bagger *et al.,* 1996), risk factors for cardiovascular diseases (CVD) (Erkkila and Lichtenstein, 2006), and hypertension (Alonso *et al.,* 2006). Moreover, high intake of dietary fibers has a positive influence on blood glucose profile and it is related health complications, in healthy and diabetic individuals of both types. By altering the gastric emptying time, dietary fibers are able to affect the absorption of other simple sugars. The effect of dietary fibers on blood glucose and insulin response has been demonstrated by many other authors as well (Onyechi *et al.,* 1998 , Chandalia *et al.,* 2000 and reviewed in Al-Weshahy and Rao, 2012).

Additionally, high content of phenolics was recorded for the tested plant by-product powders. In simillar studies, El-Wazeer, (2011) and Shalaby (2015) found that methanolic extract of ROSP showed strong activity for AA compared with ethanolic and aqueous extract which due to its high phenolic content. Also, Mohamed (2011) and Shalaby (2015) reported that total phenolic compounds content of the onion skin peel powder were well correlated to its antioxidant activity. These compounds are known have many biological properties such as antioxidant activity, antimicrobial effect, modulation of detoxification enzymes, stimulation of the immune system, decrease of platelet aggregation and modulation of hormone metabolism and anticancer property (Elhassaneen and Abd Elhady, 2014 and Shalaby, 2015).

Antioxidant evaluation of selected by-products in oil-water emulsion

Lipid oxidation is mainly responsible for off-flavour development in fatty foods, so phenolic antioxidants should be studied in suitable food system. In the present study, peroxide formation has been determined in sunflower oil-in-water emulsions incubated at 40 ^{0}C. Different amounts of tested by-products including ROSP, WOSP and PPP (10, 20 and 30 mg.ml^{-1} emulsion) were added to test their antioxidant activity. Figures (1-3) shows hydroperoxide formation during emulsion storage. Samples from PPP showed considerable antioxidant activity but onion skin powders were more effective. Regarding to this property, the all tested by-products could be arranged as follow: ROSP> WOSP> PPP.

In similar study, Elhassaneen and Sanad (2009) found that the higher antioxidant activity of red onion powder in emulsions was in good agreement with its higher levels of phenolics, Se and sulphur-containing amino acids. Also, Hegazy, (2011) found that samples from pomegranata dried samples extracts showed little antioxidant activity but its freeze drying samples extracts were more effective. The higher antioxidant activity of freeze dried powder in emulsions was in good agreement with its higher levels of phenolics.

Deep-fat frying represents an important method of food preparation of daily dishes in different countries including Egypt, either in home or in restaurants. During deep-fat frying, many physical and chemical changes occur in the frying oil that may adversely affect nutritional value and sanitation of foods. These changes include three general chemical reactions that may occur simultaneously: hydrolysis, polymerization and oxidation, which produce a great number of potential toxic decomposition products deposit on the surface of the fryer and adsorbed by the food (Pamela, 1991; Arroyo *et al*., 1992; Cuesta *et al*., 1993; Rabie and Hassan, 1996; and Elhassaneen and Shaheen, 1998).

In the last two decades, many trials are paid to use different technological processes for deep-fat frying oil treatment. Some of them include washing with water, adding of some antioxidants and bacteriological evaluation. Adding of antioxidants in oils and fats to prevent oxidative rancidity, and the safety of antioxidant substances is considered (Lee *et al*., 1995 and Serag El-Din, 2001). Therefore, they are used as food additives in order to extend the lifetime of oils and fatty foods during processing and storage. Antioxidants defined as any substance that delays or inhibits oxidative damage to a target molecule. All molecules present in living organisms are potential targets of oxidative damage: lipids, proteins, nucleic acid, and carbohydrates. When antioxidants are being studied in the laboratory, a target of attack must be selected. It may be chosen because it is important. It is often chosen merely because damage to it is easy to measure. For example,

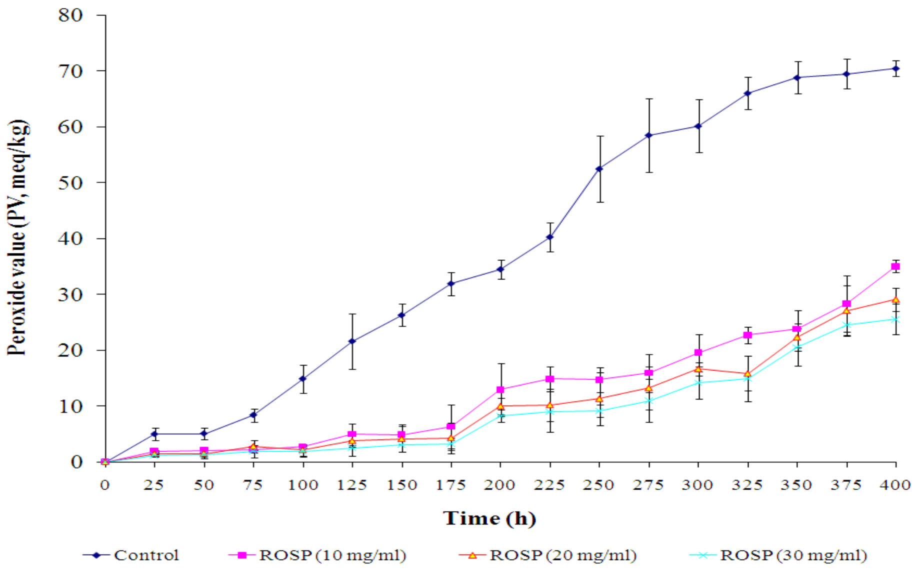

Figure 1. Effect of red onion skin powder (ROSP) on peroxide value (PV) formed in stored emulsions at 40 ^{0}C.

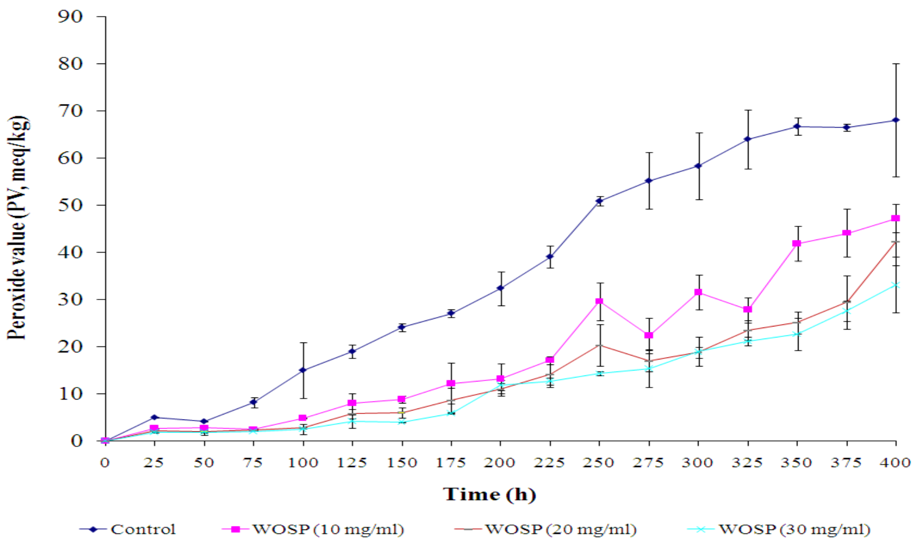

Figure 2. Effect of white onion skin powder (WOSP) on peroxide value (PV) formed in stored emulsions at 40 ^{0}C.

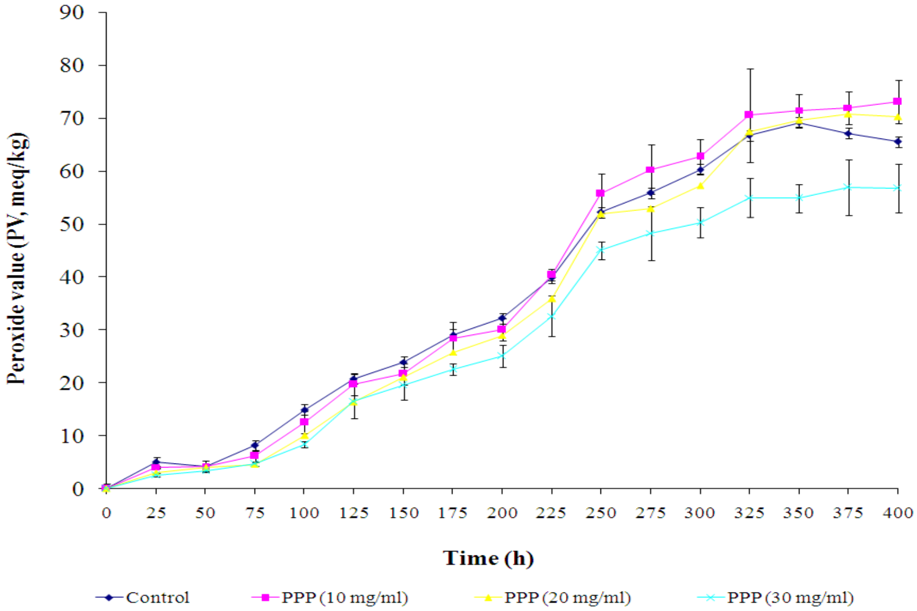

Figure 3. Effect of potato peel powder (PPP) on peroxide value (PV) formed in stored emulsions at 40 ^{0}C.

damage to lipids (lipid peroxidation) can be caused by free radical attack. It is often measured because simple assays to measure it. Otherwise, many of authorities and academic centers of research pay more attention towards the area of cancer chemoprevention compounds i.e. phytochemicals (phyto is Greek for plant). They are differing from vitamins and minerals in that they have known nutritional value. Some are antioxidants, protecting against harmful cell damage from oxidation (Ohkawa *et al.,* 1994). Others perform different functions that help prevent cancer (Elhassaneen and Abd El-Hady, 2014). Also, many studies found that some phytochemical compounds such as phenolic acids, namely caffeic, chlorogenic, ferulic, gallic protocatechuic and ellagic acid, have pharmacologically active as antioxidant, antimutagenic, and anticarcinogenic. Although many authors using some of these compounds as antioxidants in oils and fats but it is still needs more and more research to study their different mechanism of action as well as the safety of using for human health. Another technology, bioremoval of toxic substances from edible oils as affected by deep-fat frying process, was developed by Elhassaneen et al., (2004). Waste water samples from oil and Soap Company was used as a source of oil using bacteria and very simple technique for treatment the deep-fat frying oils with bacterial isolates was applied. A decrease in many toxic and/or carcinogenic compounds was observed in treated oils included free fatty acids (FFA), peroxide value (PV), malonaldehyde (MDA) and benzo(*a*)pyrene B(*a*)P contents by different rates. The rates of decreasing were increased with the increasing of oil concentration in cultural medium of used bacteria up to 15 %. Spectroscopic analysis showed that many absorbance peaks 3420, 3120, 1750 and 970–1000 nm have been disappeared which means the removal of many corresponding toxic compounds included hydroperoxides, polymerization products, carbonyl groups or acids and *trans*-ethylenic double bonds of fatty acids as the result of treatment by *Bacillus firmus*. In going with these trials, the present study was designed to use one of most abundant by-product in dehydrated food companies i.e. onion skin as a natural antioxidants in treating the edible oils. Like of these trials will be opened new avenues in food processing through using available and safe products instead of the artificial ones in particular after many questions about their toxicity and carcinogenicity have been a raised.

In addition to the previous treatments data of the present study proved that the selected by-products including ROSP, PPP and WOSP were retarted effectively the adverse chemical changes i.e. oxidation of deep-fat frying process. The using of such plant by-products as natural antioxidants instead of the synthetic one in oils industries has many nutritional and economical privileges. Synthetic antioxidants are compounds with phenolic structures of various degrees of alkyl substitution (Jacob and Burri, 1996). Science the beginning of 20^{th} century, synthetic antioxidants such as butylated hydroxyanisole (BHA) and butylated hydroxytoluene (BHT) have been used as antioxidants. Restrictions on the use of these compounds, however, are being imposed because of their carcinogenicity (Ito *et al.*,1986). Thus, the interest in natural antioxidants has increased considerably. Additionally, using of the tested by-products in food industrial application has many environmental aspects. Disposal of these materials usually represents a problem that is further aggravated by legal restrictions. Plant waste is prone to microbial spoilage; therefore, drying is necessary before further exploitation. The cost of drying, storage, and transport poses additional economical limitations to waste utilization. Therefore, agro-industrial waste often is utilized as feed or fertilizer. However, demand for feed or fertilizer varies and depends on agricultural production. Moreover, valuable nutrients contained in agro-industrial wastes are lost. Thus new aspects reported in the present study, the use of these wastes as by-products for further exploitation on the production of food additives have gained increasing interest because these are high-value products and their recovery may be economically attractive.

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الخواص الغذائية والوظيفية لبعض النواتج الثانوية الناتجة من مصانع تجفيف الأغذية

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ينتج عن مصانع التصنيع الغذائى كميات كبيرة من النواتج الثانوية والتى تعد مصادر غنية بالمركبات النشطة حيويا. لذلك تهدف الدراسة الحالية الى دراسة الخواص الغذائية والوظيفية لبعض تلك النواتج المتخلفة عن مصانع تجفيف الأغذية وهى قشور البصل الأحمر والبصل الأبيض والبطاطش. ولقد أوضحت نتائج التركيب الكيماوى ان تلك النواتج الثانوية محتواها من الرضوبة والبروتين الكلى والدهون الخام والألياف الخام ومحتوى الرماد والكربوهيدرات يتراوح بين 6,04 – 8,21 ، 10,88-2,41 ، 1,65 -8,87 ، 28,65-10,94 ، 6,88-4,52 ، 45,01-65,97% على التوالى. كم.ا سجل قشر البطاطس أعلى محتوى من البروتين بينما سجل قشر البصل الأحمر أعلى محتوى من الدهون الخام والألياف والرماد. كذلك تميزت تلك النواتج الثانوية بإرتفاع محتواها من الألياف الغذائية والكاروتينويدات والفينولات والتى سجلت قيما تراوحت بين 62,18-46,78 جرام/100جرام، 101,19-81,32 ملليجرام/100 جرام، 1087 – 9287ملليجرام حامض جاليك مكافئ/100 جرام. ولقد سجلت قشور البصل الأحمر أعلى محتوى من الألياف الغذائية والكاروتينويدات والفينولات الكلية . كما تم تقييم الخواص المضادة للأكسدة وذلك بقياس تكوين البيروأكسيدات فى نظام المستحلبات زيت عباد الشمس فى الماء والذى تبين منه أن قشور البطاطس قد سجلت أنشطة معقولة مضادة للأكسدة بينما سجلت قشور البصل أنشطة قوية ورتبت تلك المخلفات من تلك الوجهة على النحو التالى: قشر البصل الأحمر ثم قشر البصل الأبيض ثم قشر البطاطس على التوالى. لذلك خلص الدراسة الى إمكانية إستخدام تلك النواتج الثانوية كإضافات غذائية فى العديد من التطبيقات الغذائية مستقبلا نظرا لقيمتها الغذائية العالية وخواصها الوظيفية المميزة.

الكلمات المفتاحية: قشر البصل، قشر البطاطس، الكاروتنويدات، الألياف الغذائية، الفينولات، تقييم النشاط المضاد للأكسدة.