FACULTY OF AGRICULTURE

Minia J. of Agric. Res. & Develop.
Vol. (33) No. 4 pp 643-658, 2013

EFFECT OF ONION SOLID WASTES EXTRACT ON ANTIOXIDANT AND ANTIMICROBIAL PROPERTIES IN TOMATO PASTE DURING STORAGE

A. Mohammed
Faculty of Agriculture, Tishreen University, Syria
ahmad19085@yahoo.com

Received 29 Sept. 2013 Accepted 22 Oct. 2013

ABSTRACT

The scope of this study was carried out to prepare extracts from onion solid wastes and adding them to tomato paste with different levels (1000, 2000, 5000 ppm). Tomato paste was stored at room temperature (25 ±2 °C) with storage times (0, 0.5, 1, 2, 4, 6, 8 and 12 months). The total phenolic content decreased gradually during storage periods in all samples and the percentage of loss in the 5000 ppm treated sample was the lowest (46%). Antioxidant activities were determined by the free radical scavenging activity (DPPH) and by the total antioxidant capacity (ABTS). The results showed that the antioxidant activity decreased gradually during storage. The lowest percentage of loss was in the 5000 ppm treated sample, in DPPH assay (55.52%) and in ABTS (68.41%) respectively. Antimicrobial activity was confirmed by determination of aerobic bacteria, molds and yeasts. Results showed that the aerobic bacteria count decreased (1.06 log CFU/g_f), and the molds and yeasts decreased (1.37 log CFU/g_f) in the 5000 ppm treated sample. The lowest value of increasing was in the 5000ppm treated sample, for the aerobic bacteria (0.91 log CFU/g_f), and for the molds and yeasts (0.81 log CFU/g_f). Sensory evaluation of the samples showed that the 5000 ppm treated sample was the most accepted by panelists in color and odor and taste.

INTRODUCTION

Tomato fruit is widely consumed either fresh or after processing it into various products. The consumption of tomatoes has been proposed to reduce the risk of several chronic diseases such as cardiovascular diseases and certain types of cancer especially prostate cancer [1] and [2]. In addition, tomato consumption leads to decrease serum lipid levels and low density lipoprotein oxidation [3]. These health protective effects have been widely attributed to the presence of key antioxidants such as lipid-soluble lycopene and β-carotene, as well as water soluble vitamin C, and compounds of intermediate hydrophobicity such as quercetin glycosides, naringenin chalcone, and chlorogenic acid.

A large part of the world tomato crop is processed into tomato paste, which is subsequently used as an ingredient in many food products, mainly soups, sauces and ketchup. The global production of tomato paste was about 2.2 million tons in 2011, and in Syria was 23928, 23268, 16392 ton in 2008, 2009, 2010 respectively [4]. Tomato paste is a significant component in the human diet in the Middle East. It is included in the majority of homemade dishes. Production of the paste includes multiple steps, including (several) heat treatments which affect the nutritional status and stability of the end product [5].

There is an increasing demand by consumers for substituting synthetic food preservatives and other additives by natural substances as food ingredients. Among these natural and functional compounds antioxidants including polyphenols are the most widely studied [6]. For example vinification by-products (seeds and pomace) are rich source of antioxidants polyphenols [7] and [8].

Onion has been shown as one of the major sources of dietary flavonoides. It is characterized by its flavonol quercetin as well as bioactive sulfur compounds and fructopolysacharides [9]. Onion has a variety of pharmacological effects attributed to the flavonoids and sulfur containing compounds [10].

Effect of onion solid wastes extract on antioxidant

Furthermore, onion extracts could be used as a natural food ingredient for prevention the browning caused by PPO [11]. In addition, onion and some other *Allium* plants were revered to possess antibacterial and antifungal activates [12] and[13]. The antioxidant, radical scavenging and antimicrobial activities of extracts from skin and edible part of red onion have been investigated by Škerget et *al.* 2009 [14]. Their results indicated that red onion skin was a rich source of phenolic compounds, especially quercetin. Onion skin extracts also showed high antimicrobial activities against the growth of food poisoning bacteria *Escherichia coli, Pseudomonas fluorescens* and *Bacillus cereus* and fungi *Aspergillus niger, Trichoderma viride* and *Penicillium cyclopium*.

Controlling *Aspergillus niger* with garlic, onion and leek extracts have been investigated by Irkin et *al.* 2007 [15]. Their results indicated that Onion extract with ethyl alcohol (275 mg/mL MFC), aqueous garlic extract (325 mg/mL MFC) and aqueous leek extract (900 mg/mL MFC) found the most inhibitory against *A. niger*.

The growth of *Trichophyton mentagrophytes* isolate No.1 was inhibited in the presence of various concentrations of onion and garlic extract. This inhibition reached the maximum of 100% for both extracts at 10% v/v concentrations [16].

Large quantities of tomato paste are homemade in rural areas of Syria and store at room temperature. Oxidation and microbial growth are the main causes of spoilage and/or quality deterioration of the paste during storage.

Processing onion wastes (residues and surpluses) solves an environmental problem and may produce useful natural antioxidants and antimicrobial food ingredients. Thus the objective of this work is to prepare extracts from onion wastes, adding them at different levels to tomato paste, and evaluate their antimicrobial activity and antioxidants activity on tomato paste during storage at 25°C.

2. Materials and methods:

2.1. Chemicals:

Chloramphenicol glucose agar (GCA), plate count agar (PCA),PBS phosphate-buffered saline, potassium persulfate2,2-diphenyl-1-picrylhydrazyl (DPPH), Folin– Ciocalteu's phenol reagent, ABTS [2,2-azinobis(3-ethylbenzothiazoline-6-sulfonic acid), Trolox [6-Hydroxy-2,5,7,8-tetramethylchroman-2-carboxylic acid], and gallic acid were obtained from Sigma–Aldrich, Inc.

2.2. Equipments:

The Equipments were Spectrophotometer (Jasco V-530, USA), Centrifuge (220.87 V11, Z216 MK, Germany), Heating magnetic stirrer (F20500010, AREC, VELP, Italy), pH meter (Milwaukee, Mi180, Italy), Small Centrifuge (EBA 20, Germany) and Stomacher Lab Blender 400 (Seward medical, London, England).

2.3. Samples:

*2.3.1. **Onion solid wastes:*** Processing and stabilization treatments of onion wastes from the harvesting period of 2009 (*Allium cepa* L. var. *cepa*) were supplied by onion drying factory, Salamia (Hama, Syria). Onion solid wastes consisted of the outer dry layers and apical trimmings were freez-dried by lyophilizer. Freeze dried onion wastes (80 g) were homogenised with 400 ml (60% ethanol/ 0.1% HCl) and extracted at 40 °C for 6 h [17]. The homogenate was centrifuged at 17,500g for 20 min at 4 °C. The supernatants were vacuum filtered through a 0.45 μm membrane filter [9].

*2.3.2. **Tomato paste:*** Tomato paste was prepared from whole fruits (*Elegro* var.) by using a pilot line at Morino Company (Homs, Syria). Onion waste extracts were incorporated into tomato puree. The purees were concentrated to 32° Brix at temperature 60°C and vacuum 60-70mmHg (checked by refractometry). Glass containers (200 mL) were filled with hot tomato paste and then flash-pasteurized at 85°C for 1 min.

2.4. Analysis:

2.4.1. Bioactive determination:

A) Preparation of Extracts: The estimation of the total phenolic content and the total antioxidant activities was done by using spectrophotometric assays. 2 mL of 75% methanol was added to a 0.2 g freeze-dried sample. After centrifugation at 2500 rpm for 10 min, the supernatant was collected, another 2 mL of 75% methanol was added to the pellet, and the extraction procedure was repeated. Both supernatants were combined and adjusted to a final volume of 5 mL. This solution was used as a hydrophilic extract. Then, lipophilic compounds was extracted from the pellet by using 5 mL of 2-propanol to finally dissolve the metabolites. This solution was used as the lipophilic extract [5].

B) Spectrophotometric Assays:

1) The total phenolic content was estimated by using Folin-Ciocalteu reagent [18], using 100 μL of lipophilic extract, 900 μL of pure water, and 5 mL of reagent. The preparation of a standard curve, 0.10–0.50 mg/mL gallic acid was used, and data were expressed as milligrams of gallic acid equivalents (GAE) per 100 g dry weight.
2) Total antioxidant levels were estimated by two different tests. All assays were performed on both extracts the hydrophilic and the lipophilic ones. In all assays, trolox was used as a reference compound, and results were expressed in terms of micromoles of trolox equivalent antioxidant capacity (TEAC) per 100 g dry weight.

- The ABTS [2, 2-azinobis (3-ethylbenzo- thiazoline-6-sulfonic acid) diammonium salt] method was used according to Miller et *al.*, 1997[19]. For the hydrophilic extracts the ABTS stock solution was diluted in 50 mM potassium phosphate buffer, pH 8.0, instead of 5 mM PBS. Then, 100 μL of sample extract or standard was mixed with 1 mL of ABTS-working solution (final pH of the reaction mixture was about 7.4), and after exactly 40 seconds the remaining ABTS radicals were measured at 734 nm.

- The DPPH (1,1-diphenyl-2-picrylhydrazyl) method [20] was performed by mixing 100 μL of both types of sample extract with 2 mL of 0.1 mM DPPH in methanol (not buffered). After incubation at room temperature for 30 min in the dark, the absorbance of the mixture was measured at 517 nm.

2.4.2. Microbial growth:

Aerobic bacteria counts, yeast and mold were evaluated during storage of tomato paste according to [21] and [22]. The analyses were carried out at 0, 0.5, 1, 2, 4, 6, 8 and 12 month. In sterile conditions, 10 g of tomato paste were homogenized for 2 min with 90 ml of 0.1% sterile peptone water with a Stomacher Lab Blender 400 (Seward medical, London, England). Serial dilutions of tomato paste homogenates were poured in plate count agar (PCA) at 30 ± 1 °C for 3 days for aerobic bacteria counts, chloramphenicol glucose agar (GCA) at 25 ± 1 °C for 5 days for yeast and mold counts.

2.4.3.*Sensory evaluation:*

Tomato paste samples with onion waste extract added at 1000, 2000, 5000ppm were used to prepare ketchup which was assessed by a group of 50 panelists. Ketchup samples were given to panelists to eat with potato chips. The panelists were asked to evaluate color, taste and odor of the food samples on a scale from 1 to 5 fallows:

1 - <3 the sample is unacceptable.
3 - >3.5 the sample is acceptable.
3.5- > 4 the sample is good.
4 - >4.5 the sample is very good.
4.5 - ≥5 the sample is excellent.

The data from panelists were pooled and the mean values, standard deviations and least significant were calculated [23].

2.4.5. Statistical analysis:

Results were given as mean ± standard deviation of six independent determinations. One-way analysis of variance (ANOVA)

was used to compare the means. Differences were considered significant at $P < 0.05$. All statistical analyses were performed with MINITAB 12.

3. Results and discussion:

3.1. Physico-chemical analysis of the studied tomato paste:

Table 1 shows some Physico-chemical characteristics of the used tomato paste samples.

Table 1: Physico-chemical characteristics of studied tomato paste [a]

Parameters		Value (mean ± SD)
Soluble solids (° Brix)		32.0 ± 0.05
Titratable acidity (g citric acid/100 g_f)		3.38 ± 0.02
pH		4.08 ± 0.03
Total Phenolics (mg of GAE/100 g_d)		204.35 ± 34.11
Antioxidant Activity DPPH(μmol of TEAC/100 g_d) ABTS (μmol of TEAC/100 g_d)		255.7 ±7.4 1277 ± 170
Color	a^*	16.73 ±0.59
	b^*	25.90 ± 0.64
	L^*	30.15 ± 0.30
	a^*/b^*	1.54 ± 0.06
Aerobic bacteria count (CFU/g)		3.4×10^3
Molds and yeasts (CFU/g)		1.3×10^2

[a] Values are means ± SD, n = 6.

As shown in Table 1, the values of acidity, pH, Brix and color were within the Syrian standards of tomato paste [24]. The value of total phenolic content (204.35 mg of GAE/100 g_d) was similar to that found by Capanoglu et *al.* 2008. Furthermore, the values of antioxidant activity in both DPPH and ABTS assays were 255.7 ± 7.4 , 1277 ±170 μmol TEAC/100g respectively, These values were also similar to that found values of Capanoglu et *al.* 2008. Microbial Aerobic count and molds and yeasts were 3.4×10^3, 1.3×10^2 CFU/g_f, and this is similar to that found value by Omidbeygi et *al.* 2007.

3.2. Total phenolic content and antioxidant activity in onion waste and its extract:

Table 2 shows the phenolic content and antioxidant activity of onion waste and its extract.

Total Phenolic content was 272.6 ± 21.5 , and 392.5 ± 27.9 mg GAE/100 g_d of onion waste and its extract respectively. The values of antioxidant activity in both DPPH and ABTS assays 396.8 ± 16.7, and 780 ±13µmol TEAC/100 g_d of onion waste, 639.3±15.94, 1821±29 µmol TEAC/100 g_d of its extract respectively, which were similar to that found by of Roldán et *al.* 2008.

Table 2: Total Phenolic and Antioxidant Activity in onion solid waste and its extract [a]

	Total Phenolics (mg of GAE/100 g_d)	Antioxidant Activity	
		DPPH (µmol of TEAC/100g_d)	ABTS (µmol of TEAC/100 g_d)
Onion solid wastes	272.6 ± 21.5	396.8 ± 16.7	780 ± 13
Onion solid wastes extract	392.5 ± 27.9	639.3 ± 15.9	1821± 29

[a] Values are means ± SD, n = 6.

3.3. Bioactive composition:

3.3.1. Total phenolic in tomato paste during storage at room temperature 25 ± 2 C:

The data of total phenolic content (Table 3), using the Folin-Ciocalteu assay, indicated that adding the extract directly to tomato paste at levels of 1000, 2000 and 5000ppm respectively increased the total phenolic content (mg of GAE/100 g_d) by 165%, 337% and 775%.

Table 3: Total Phenolic content in tomato paste during storage at room temperature 25 ± 2C [a]

Storage Interval Months	Total Phenolic content (mg of GAE/100 g_d)			
	Control	1000ppm	2000ppm	5000ppm
0	204.3±34.1	542.0±29.2	894.2±38.8	1789.4±41.3
0.5	189.8±20.1	531.5±12.4	810.2±29.4	1691.8±43.1
1	167.9±19.3	511.3±11.5	794.3±31.1	1656.1±32.8
2	151.9±12.1	498.6±12.3	761.2±28.4	1580.8±12.6
4	137.8±18.2	471.1±15.6	732.1±19.2	1489.2±16.1
6	122.4±17.2	448.1±14.1	678.2±15.3	1310.1±15.3
8	104.2±9.7	397.8±13.4	591.4±34.1	1145.4±23.5
12	80.2±4.6	250.3±17.7	430.4±21.3	973.3±21.8
LSD	14.21	15.71	13.45	16.65

[a] Values are means ± SD, n = 6.

The content decreased gradually during storage in all samples including the control which lost 60.6% of its phenolics after 12 months. The percentage of loss in the 1000, 2000, 5000ppm samples was 54, 52 and 46% respectively.

3.3.2. Antioxidant Activity in tomato paste during storage at room temperature 25 ± 2° C:

Table 4 showed the antioxidant activity in tomato paste during storage at room temperature.

Adding the extract directly to tomato paste affected the antioxidant activity (μ mol of TEAC/100g_d) and led to increase in the antioxidant activity 139.06%, 260.53%, 639.22% in DPPH assay and 144.32%, 238.37 %, 457.79 % in ABTS assay in 1000, 2000, and 5000 ppm samples, respectively.

Table 4: Antioxidant Activity in tomato paste during storage at room temperature 25 ± 2 C [a]

Storage Interval Months	Antioxidant Activity							
	DPPH(μ mol of TEAC/100 g_d)				ABTS (μ mol of TEAC/100 g_d)			
	Control	1000ppm	2000ppm	5000ppm	Control	1000ppm	2000ppm	5000ppm
0	255.7±7.4	611.3±9.1	921.9±11.1	1890.2±29.1	1277±170	3120±153	4321±240	7123±220
0.5	231.2±4.2	560.1±11.2	872.1±10.2	1843.1±21.8	1102±132	2895±145	4210±145	6600±119
1	200.9±6.1	524.1±13.8	790.21±7.2	1767.7±21.2	954±121	2301±98	3932±198	5890±220
2	187.9±8.9	430.12±9.2	773.10±6.6	1621.3±11.3	862±125	1993±60	3056±141	5210±129
4	167.1±5.4	412.32±6.6	730.14±13.1	1522.1±19.2	793±101	1867±123	2975±123	4950±1221
6	140.1±6.1	391.14±8.2	691.1±8.2	1441.3±12.5	751±111	1611±81	2010±165	4510±114
8	110.9±5.3	356.7±11.3	576.12±14.3	1300.2±38.1	523±76	1237±65	1572±123	3010±99
12	78.23±32	232.3±14.6	410.12±11.3	1017±12.5	365±34	984±43	1123±47	2250±67
LSD	11.78	15.91	22.56	26.61	48.95	40.35	76.52	114.81

[a] Values are means ± SD, n = 6.

The gradual decrease was observed in control reaching 69.40%, 71.41% in DPPH and ABTS assays. The percentages of loss were 61.99%, 55.52%, 46.1% in DPPH assay, 68.46%, 74.01%, 68.41% in ABTS assay in the 1000, 2000 and 5000ppm samples respectively at the end of the storage period.

3.4. Aerobic bacteria count and molds and yeasts in tomato paste during storage at room temperature 25±2° C:

Results in Table 5 showed the effect of onion solid waste extract at levels (1000, 2000, 5000ppm) against the Aerobic bacteria count, yeasts and molds of tomato paste stored at room temperature.

Adding the extract directly in different levels to tomato paste led to decrease in the Aerobic bacteria count 0.17, 0.4 and 1.06 log CFU/g_f in the 1000, 2000, and 5000 ppm samples, respectively. A gradual increase in Aerobic bacteria count was 2.15, 1.16, 1.1 and 0.91 log CFU/g_f in the control, 1000, 2000 and 5000ppm samples respectively at the end of the storage period.

Moreover, adding the extract directly in different levels to tomato paste led to decrease the molds and yeasts 0.31, 0.52, 1.37 log CFU/g_f in

the 1000, 2000, and 5000 ppm samples, respectively. Also, a gradual increase in molds and yeasts was 2.33, 1.88, 1.67 and 0.81 log CFU/g_f in the 1000, 2000, and 5000 ppm samples, respectively. Onion was revered to possess antibacterial and antifungal activities, because it contains powerful sulfur and other numerous phenolic compounds [25].

Table 5: Aerobic bacteria count and molds and yeasts in tomato paste during storage at room temperature 25±2C[a].

Storage Interval Month	Aerobic bacteria count (log CFU/g_f)				Molds and yeasts (log CFU/g_f)			
	Control	1000ppm	2000ppm	5000ppm	control	1000ppm	2000ppm	5000ppm
0	4.27± 0.32	4.1 ±0.11	3.87 ±0.31	3.21 ±0.10	2.32±0.04	2.01±0.07	1.8±0.02	0.95 ±0.02
0.5	4.31 ±0.09	4.19 ±0.08	3.92 ±0.14	3.33 ±0.04	2.44±0.03	2.15±0.03	1.89±0.07	1.10±0.05
1	4.43 ±0.17	4.21 ±0.21	3.99 ±0.05	3.36 ±0.16	2.56± 0.05	2.26±0.11	2.01±0.05	1.21±0.07
2	4.44 ±0.05	4.22 ±0.14	4.12 ±0.09	3.49 ±0.17	2.98± 0.09	2.43±0.06	2.23±0.08	1.33±0.04
4	4.51 ±0.07	4.31 ±0.26	4.13 ±0.25	3.73±0.25	3.56± 0.12	2.66±0.08	2.41±0.06	1.46±0.09
6	4.62 ±0.23	4.42 ±0.13	4.19 ±0.16	3.91 ±0.03	4.11±0.13	3.12±0.05	2.67±0.09	1.56±0.09
8	5.38±0.09	4.79 ±0.15	4.34±0.19	4.11±0.05	4.23±0.06	3.25±0.08	2.98±0.06	1.69±0.18
12	6.42±0.08	5.26±0.08	4.97±0.14	4.12±0.09	4.65± 0.08	3.89±0.06	3.47±0.19	1.76±0.05
LSD	0.29	0.17	0.19	0.1	0.12	0.15	0.07	0.01

[a] Values are means ± SD, n = 6.

3.5. Sensory evaluation:

Tomato paste samples were sensory evaluated at 0, 0.5, 1, 2, 4, 6, 8 and 12 months of storage for color, taste, and odor (Table 6). A decreasing trend in sensory scores of tomato paste samples was observed at all levels with increasing time of storage. As far as color, a gradual decrease was observed with the highest loss in color (40%) was recrded in the control sample and the lowest loss (15%) in the 5000ppm sample. The color scores for the samples after storage for 12 months were unacceptable (2.97), acceptable (3.01), good (3.89) and very good (4.23) for control, 1000, 2000 and 5000ppm samples respectively. The deterioration of color is due to the degradation of lycopene as while as the non-enzymatic browning [26].

The taste changes were affected by the level of the added extract, a gradual decrease was observed in taste scores of all samples during storage and ranged between 15 and 40%. The taste scores for the samples after storage for 12 months were unacceptable (2.85), acceptable (3.17), good (3.48) and very good (4.02) for control, 1000, 2000 and 5000ppm samples respectively.

Similar results were obtained for the odor at different levels of the added extract. Odor loss was the highest (39%) in the control sample and it was the lowest (19%) in the 5000ppm sample. The odor scores after storage for 12 months were unacceptable (2.91), acceptable (3.45), good (3.58) and good (3.59) for control, 1000, 2000 and 5000ppm samples respectively. The major cause of flavor deterioration (taste and odor) may be due to the Maillard reaction which was reported to give a bitter off-flavor [27].

Table 6: Effect of storage time and extract level on sensory attributes of tomato paste [a]

Storage Interval Month	Color				Taste				Odor			
	Control	1000ppm	2000ppm	5000ppm	Control	1000ppm	2000ppm	5000ppm	Control	1000ppm	2000ppm	5000ppm
0	4.96±0.21	4.94±0.19	4.95±0.11	4.96±0.13	4.75±0.34	4.73±0.40	4.71±0.22	4.78±0.25	4.77±0.33	4.65±0.17	4.61±0.13	4.45±0.32
0.5	4.87±0.23	4.91±0.26	4.92±0.15	4.94±0.16	4.61±0.25	4.54±0.17	4.51±0.41	4.63±0.12	4.57±0.37	4.49±0.15	4.56±0.18	4.39±0.27
1	4.65±0.09	4.82±0.11	4.89±0.11	4.90±0.14	4.56±0.25	4.51±0.11	4.51±0.31	4.59±0.11	4.47±0.31	4.42±0.12	4.50±0.15	4.32±0.27
2	4.34±0.16	4.45±0.11	4.67±0.19	4.79±0.19	4.43±0.12	4.41±0.13	4.41±0.32	4.49±0.51	4.31±0.37	4.26±0.11	4.41±0.14	4.22±0.43
4	3.91±0.13	4.02±0.23	4.23±0.14	4.64±0.14	4.03±0.14	4.11±0.14	4.21±0.30	3.41±0.11	3.89±0.21	3.98±0.27	4.37±0.16	4.01±0.21
6	3.45±0.12	3.54±0.09	4.12±0.14	4.54±0.11	3.43±0.12	3.58±0.17	3.93±0.10	4.32±0.19	3.75±0.22	3.82±0.13	3.94±0.13	3.84±0.11
8	3.34±0.13	3.46±0.08	4.01±0.17	4.46±0.14	3.32±0.15	3.26±0.13	3.71±0.12	4.11±0.16	3.25±0.21	3.71±0.11	3.71±0.1	3.78±0.21
12	2.97±0.12	3.01±0.06	3.89±0.14	4.23±0.09	2.85±0.12	3.17±0.06	3.48±0.06	4.02±0.1	2.91±0.22	3.45±0.22	3.58±0.11	3.59±0.17
LSD	0.04	0.02	0.05	0.06	0.03	0.01	0.08	0.04	0.07	0.08	0.08	0.06

[a] Values are means ± SD, n = 6.

4. Conclusion:

It could be deduce from this research that onion industry residues extract had antioxidants, and antimicrobials properties and these extracts can be used as supportive material in waste-enhanced food. Adding these

extracts to tomato paste gave it high ability to maintain the sensory attributes, and they reduce the lossin antioxidant activities. Also, they reduce the aerobic bacteria count and molds and yeasts. The level 5000 ppm was the best in maintaining antioxidant properties, antimicrobial properties, and sensory attributes.

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A. Mohammed

تأثير مستخلص المخلفات الصلبة للبصل على الخصائص المضادة للأكسدة والمضادة للميكروبات في عجينة الطماطم خلال التخزين

احمد محمد
كلية الزراعة، جامعة تشرين، سوريا

ان الهدف من هذا البحث هو تحضير مستخلصات من المخلفات للبصل ،وإضافتها إلى عجينة الطماطم بتراكيز مختلفة (5000،2000،1000). وقد تم تخزين عجينة الطماطم على درجة حرارة الغرفة 25±2 °م ، لفترات زمنية شهرا . أظهرت النتائج حدوث فقد تدريجي في المحتوى الفينولى الكلى خلال التخزين في جميع العينات ،وكانت النسبة المئوية للفقد فى العينة المحتوية على 5000ppm الاقل (46%). ، DPPHتم تقدير الفعالية المضادة للأكسدة باختبار الفعالية الكابحة للجذور الحرة واختبار القدرة المضادة للأكسدة الكلية ABTS. اظهرت النتائج انخفاض الفعالية للأكسدة تدريجيا خلال التخزين . اقل نسبة مئوية للفقدان كانت فى العينة المحتوية على 5000ppm مستخلص ، فهي 55.52% فى اختبار DPPH ، و 68.41% فى اختبار ABTS . أيضا تم تقدير الفعالية المضادة للميكروبات بتقدير البكتريا الهوائية ،الخمائر والفطريات . أظهرت النتائج انخفاض تعداد البكتريا الهوائية بمقدار1.06 Log CFU/gr ، وانخفاض تعداد الخمائر والفطريات 1.37 Log CFU/gr فى عينة مضاف لها 5000ppm مستخلص عند اضافتة مباشرة الى عجينة الطماطم. كانت القيمة الاقل للتزايد فى عينة مضاف لها 5000ppm مستخلص ، وهى للبكتريا الهوائية 0.91Log CUF/gr وللخمائر والفطريات 0.81Log CFU/gr فى نهاية التخزين. وقد اوضح التقييم الحسى ان العينة المضاف لها 5000ppm مستخلص هى الاكثر قبولا من قبل المحكمين من حيث اختبارات اللون والرائحة والطعم .