Effect of Different Extraction Methods on Stablity of Anthocyanins Extracted from Red Onion peels (*Allium cepa*) and Its Uses as Food Colorants

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ABSTRACT

The present work was carried out to produce a natural red color (anthocyanins) from red onion peels (Allium cepa) by four different solvent for coloring some food product. The results showed that acidified ethanol (0.01%Hcl) had the greatest efficient in extracting red onion peels anthocyanins followed by acidified methanol (0.01% Hcl), while acidified distilled water (0.01%) and distilled water are the less effective. At low pH(2.0 and3.0),natural anthocyanins extracts exhibited their greatest stabilities. Red onion peels anthocyanins extracts by acidified methanol was heated for 30 min at temperatures of 40, 60, 80 and 100°c retained 99.16, 98.79, 91.56 and 69.45 %, respectively. The highest stability of anthocyanins extracted by both of acidified methanol and ethanol was at 40 to 80°c until holding time reached to 60 min. Color and overall acceptability of hard candy containing 0.3% natural anthocyanins extracted from red onion peels by acidified methanol recorder highly score with synthetic color (Allure).On the other hand, glazing jelly containing 0.25% natural anthocyanins extracted from red onion peels by all solvents recorded closely score with synthetic color.

Keywords: *Onion peels; Natural color; Anthocyanins; Extraction; Stability; Uses.*

INTRODUCTION

Waste prevention, minimization and valorization are widely recognized as more desirable solution for waste management than "end of pipe" treatment. Large quantities of both liquid and solid wastes are produced annually by the food processing industry. There wastes materials contain principally biodegradable organic matter and their disposal creates serious environmental problems **(Ayala-Zavala *et al.*, 2011).** The main phytochemical compounds present in fruits and vegetables are flavonoids, anthocyanins, vitamins C and E, phenolic compounds, dietary fibers and carotenoids **(González-Agiular *et al.,* 2008)**. Wastes utilization from food processing industries is highly indispensable and challenging task all around the globe; numerous researchers have worked on food ingredients like natural colors, an attempt to collate the work done on the waste treatment from fruits, vegetables and cereals **(Shalini *et al.,* 2015).**

Red onions, (*Allium cepa L.*) contain anthocyanins and colorless phenolics in dried outer skins and the epidermal layer of their fleshy scales. That the major pigment in red onions was cyaniding3-glucoside, with lesser amounts of cyaniding 3-laminaribioside and other minor unidentified cyaniding, peonidin and pelargonidin glucosides that showed by **Robinson and Robinson (1932); Bradwein, (1965) ; Fuleki ,(1969;1971) and Du *et al.*, (1974).** However, the exploration of onion anthocyanin as food coloring properties is promising **(Guinot *et al.*, 2007).**

The outer dry layers on onion bulbs, which are not edible and removed before processing have been shown to contain a wide spectrum of polyphenolic components so, the aim of many researches to produce high added – value preparations that could be used in the food industry both as alternatives to synthetic antioxidants , colorants and functional ingredients with potent beneficial bioactivities.

To the extract the substances retried are proven generally safe and could effectives replace synthetic analogues , the results may be directly applicable to the development of morel food commodities whose consumption will contribute towards a healthier lifestyle as mentioned by **Khiari *et al.*, *(*2008).**

Anthocyanins, as natural colorants, are widely used in the food industry as an alternative to synthetic colorants, e.g., they can replace FD&C red No. 40 (Allure red). They are characterized a wide spectrum of color tones, ranging from orange through red, to purple and blue depending on the molecular structure and pH value **(Dorota and Janusz ,2007).** In recent years, the interest in using anthocyanins as natural alternative to synthetic food colorings is constantly increasing. In addition to their coloring efficiency, increasing evidence suggests that anthocyanins are not only non-toxicant mutagenic, but also have a wide range of therapeutic properties, **(Tatiana *et al.*, 2012).**

The interest of anthocyanis derives not only from their coloring effect but also from their beneficial properties, including ant oxidizing activity, improvement in the tightness of capillary blood vessels and prevention of thrombosis aggregation, all of which reduce the risk of circulatory disease **(Gluslt and Wrolstad, 2003).**

Colored raisins resembling arrange of different fruits may be used to enhance the appearance of baked goods, breads, snacks, dairy desserts and other products (**Pszezola, 2002**). Synthetic colors are responsible for various complications such as asthma, urticaria, abortion, hyperactivity of children, carcinogenicity, decreased IQ of children, anaphylactic reactions, idiosyncrasy, sleeping disorders, hypertension, weakening of the immune system, decreased WBC and lymphocyte count and vitamin B6 deficiency **(Geoffrey and Felix, 1991; Hinton, 2000).**

The increasing use of natural food colorants with the confectionary industry is discussed .Individual aspects include : reasons for using natural colorants in confectionery ; green, yellow and orange colorants pink ,red and purple colorants ;blue food colorants; choosing the right color for different confectionery products (gums and Jellies ,sugar coated confectionery , foam products , hard boiled candy , fat-based coating)and health benefits associated with certain natural colorants , antioxidant activities , possible protection against cardiovascular disease and cancer (**Nielsen,1999**).

So, the aim of this study was to extract and determine the natural anthocyanins from red onion peels ***(Allium cepa)*** and also, to study the effect of pH, temperature and time on their stability and utilizing them in some confectionery products, i.e. hard candy and glazing jelly.

MATERIALS & METHODS

Materials

Red onion peels (*Allium cepa*) was purchased from local stores at Cairo during the season of 2014/2015. All solvents used in analysis were of HPLC grad, from GFS chemicals Co. (USA).Synthetic food color (Allure) and flavoring oil were from Kamina Co. for food products, Cairo, Egypt. Corn syrup obtained from Egyptian Starch and Glucose Manufacture Co. for food products, Cairo, Egypt. Carragenan and Hcl were obtained from Sigma Chemicals Co., USA. Sorbic acid, calcium chloride, potassium sorbate, sucrose; citric acid was used for analysis obtained from El Gomhouria Co Cairo, Egypt.

Methods

Preparation of red onion peels

Red onion peels were cleaned from impurities and washed with tap water and dried in air oven(Carbolite) at 45ºC for 24 hours ,then crushed into powder prior to analysis using Broun blender according to **(Velickovska *et al.*, 2013)**

Extraction of anthocyanins colorant from red onion peels

Anthocyanins were extracted from red onion peels according to **Rodriguez-Saona and Wrolstad, (2001).**Ten gram of ground red onion peels soaked overnight at 4ºC in solvent using different extraction solvents :(1) acidified methanol (0.01% Hcl 37%); (2) acidified ethanol (0.01% Hcl 37%);(3) acidified distilled water (0.01% Hcl 37%), and(4) distilled water. The anthocyanins extract was filtrate through filter paper Whatman No.1 into conical flask. The extraction and filtration continued till the residue was colorless. The anthocyanins extract was concentrated by rotary vacuum evaporator at 40 ºC.

Determination of total anthocyanins

The filtered anthocyanin extract was diluted with the extracting solvent measured at 520 nm.The total anthocyanin was calculated using equation descried by **Du and Francis, (1973).**

Total anthocyanins mg/100g= Absorbance X dilution factor/ Sample weight X Extinction coefficient*

***:** (26900 molar in L X mol^{-1} X cm^{-1}. for cyaniding -3-glucoside).

One gram of anthocyanin was absorption to 1gm of solid matrix (anhydrase dextrin) and dried in oven at 40ºC for 24 hours according to **Rizk et *al.*, (2009).**

Anthocyanin stability

Effect of pH

Effect of different pH values on anthocyanin retention was measured according to the method described by **Elbe and Huang, (1974)**, one ml of extracted anthocyanins solution was mixed with4 ml of Mcllvaines buffer of various range from 2.0 to 9.0 at 4ºC and absorbance readings were measured using spectrophotometer at 520 nm.

Effect of temperature

Effect of temperature on anthocyanins retention was measured according to **Saguy (1979)** with some modifications. 1 ml of extracted anthocyanins solution and 9 ml of optimum buffer solution to adjusted pH2.0 were pleased in a thermostatically controlled water bath at different temperatures (40,60,80 and 100ºC) for 30min.The samples were further cooled down immediately in an ice water bath and absorbance measurements were read by spectrophotometer at 520 nm.

Thermal stability

Anthocyanins solution was hold at pH value 2.0 for 30, 60, 90 and 120 min at 40, 60, 80 and100ºCin water bath then cooled immediately in an ice water bath and measuring absorbance of solution by spectrophotometer at 520 nm.

Applications

Hard candy Processing:

Hard candy was manufactured in the laboratory using the procedure as described by **Staniec (1994).**The formulation of control sample was shown in Table (1).

Procedures in steps:

- Water, sucrose, corn syrup and citric acid were mixed together and heated to reach 157.5ºC with continuous stirring and then the mixture was cooled to reach 110ºC.
- Synthetic red color (Allure) was added at 9.5 mg/100g of whereas natural anthocyanins extracted from red onion peels were added at 0.15, 0.20, 0.25 and 0.30mg/100g of mixture.
- Flavoring agent was added to the formula, and then formulated and cooled to reach room temperature and then packed.

Glazing jelly processing:

Glazing jelly prepared in the laboratory using the ingredients which were given in table (1) according to **Gad Allah *et al*., (2002).**

Procedures in steps:

- A mixture of sucrose and carragenan was boiled first in the water then calcium chloride, sorbic acid and potassium sorbate were added to the mixture.
- Corn syrup was added continuous stirring.

- After complete dissolving of the ingredients the heating was stopped**.**
- A synthetic color (Allure) was used at 9.5 mg/100g of the mixture whereas natural anthocyanin extracted from red onion peels were added at 0.20, 0.25 and 0.30 mg/100gm of the mixture.
- Flavoring agent was added.
- Glazing jelly samples were cooled in the refrigerator for 5 h.

Sensory evaluation

Samples of hard candy and glazing jelly were subjected to sensory evaluation by ten panelists from National Nutrition Institute (NNI)**.** Panelists were asked to evaluate color, clarity, flavor, texture, graininess and overall acceptability of the glazing jelly and color, flavor, texture, clarity, mouth feel and overall acceptability of the hard candy processed according to the method described by **Reitmeler and Nonnecke (1991).**

Statistical analysis:

Analysis of variance and Duncan's multiple range test was carried out according to Statistical Analysis System **SAS, (2006)** at the computer center, Faculty of Agriculture, Ain shams University.

RESULTS & DISCUSSION

Total anthocyanins

Ethanol acidified with HCl 0.01% , methanol acidified with HCl 0.01% ,distilled water and distilled water acidified with HCl 0.01% were used in extracting anthocyanin from red onion peels . Total anthocyanins extracted with the different solvents are shown in Figure (1). Addition of acids to methanol and ethanol increased the efficient of anthocyanins extraction compared with the distilled water and acidified distilled water. In general ,the results indicated that ethanol acidified with HCl showed the strongest influence on amount of extracted anthocyanins followed by methanol acidified with Hcl and then distilled water. These results are similar to the results recorded by **Selim *et al*., (2008) and Mattuk, (1998).**

The effect of different pH values on retention % of anthocyanins extracted from red onion peels by different solvents was presented in Table (2). Results showed that the retention % of anthocyanins extracted from red onion peels by different solvents was found to increase with elevating the pH values. Significant differences were observed between different pH values. Generally, increasing the pH value from 2.0 to 7.0 the anthocyanins instilling were gradually increased it means that anthocyanins were more stable at acidic pH values. The maximum retention (%) of anthocyanins found at pH 2.0 to extraction with acidified methanol (99.17%) followed by acidified ethanol (96.55%), then acidified distilled water (95.25%) and distilled water (94.76%). On the other hand, the same anthocyanins may present different trends due to pH variation such as neutral solutions decreased the retention rate of anthocyanins, on contrary ,alkaline solution increased the retention. These results agree with **Revilla *et al.,* (1998); Heredia et al., (1998) and Gauche *et al., (*2010).**

The effect of different thermal treatments on retention rate (%) (Based on absorbance values measured for anthocyanins extracts before and after heat treatments) of anthocyanins extracted from red onion peels by methanol acidified by Hcl, ethanol acidified by Hcl, distilled water acidified by Hcl and distilled water was illustration Table (3).The results showed that the anthocyanins degradation significantly ($P>0.05$) increased when the treatment temperature was increased from 40 to 100ºC /30 min at pH 2.0. Prolonged exposure of natural anthocyanins colors at moderate temperature ranged between 40 and 60ºC. Showed similar stability were observed whereas at above 60ºC, the degradation in anthocyanins color extracted by all used solvents increased gradually by increasing temperature. The highest retention rate was (99.16%)at 40ºC /30min. for anthocyanin extracted from red onion peels by methanol acidified Hcl followed by (99.15%) and (99.11%) for anthocyanins extracted from red onion peels by ethanol acidified by Hcl and distilled water acidified by Hcl. This results were agree with **Laleh *et al.,(*2006); Selim *et al.,(*2008) , Rizk *et al*., (2009) and Sharif *et al.,* (2010) .**

The thermal stability of anthocyanins color extracted from red onion peels by different solvents on duration time at various temperatures ranged between 40 and 100ºC are presented in Tables (4 to7). Results indicated that, the increase of destruction occurred by increasing the duration time and temperatures for all natural anthocyanins color extracted from red onion peels by all used solvents, On the other hand, the retention of natural anthocyanins color extracted from red onion peels by methanol acidified by Hcl , ethanol acidified by Hcl , distilled water acidified by Hcl and distilled water being 45.67, 39.47 , 31.17 and 30.66% after holding time for 120 min at 100ºC, respectively. The highest retention of anthocyanins observed at 40 and 60ºC unit holding time reached to 120 min. for all used solvent compared to other thermal treatments. The highest stability anthocyanins extracted by both of acidified methanol and acidified ethanol was at 40 to 80ºCuntil holding time reached to 60 min. These results agree with **Mohamed *et al.,* (2006); Santos et *al.,* (2012). Markakis, (1982)** suggested that, stability of anthocyanins pigments has been influenced by enzymes, pH, temperatures, oxygen, light and metals. It could conclude that, the degradation of red onion peels anthocyanins greatly influenced by temperature and holding time. Finally it could be noticed that anthocyanins extracted by both of acidified methanol and ethanol showed higher thermal stability at different temperatures that are required for several processing of different products.

Applications Hard candy

Sensory attributes of hard candy prepared with different levels of anthocyanins extracted from red onion peels by different solvents (acidified methanol , acidified ethanol acidified distilled water and distilled water) were statistically analyzed and results are given in Table (8) and Fig.(2).No significant difference was observed in flavor , texture , clarity and mouth feel of hard candy prepared with different levels of anthocyanins extracted from red onion peels by different solvents and synthetic color. On the other hand, color and overall acceptability of hard candy prepared with 0.3% natural anthocyanins extracted from red onion peels by acidified methanol and ethanol recorded highly score with synthetic color while, color and overall acceptability of hard candy prepared with 0.2 and 0.25% natural anthocyanins extracted from red onion peels by acidified and non-acidified distilled water recorder closely scores with synthetic color.

Glazing jelly

Sensory attributes of glazing jelly prepared with different levels of anthocyanins extracted from red onion peel by different solvents (acidified methanol , acidified ethanol , acidified distilled water and distilled water) were statistically analyzed and the results are given in Table(9)and Fig.(3).No significance difference was observed in texture and graininess while slightly significant difference was observed in flavor and clarity of glazing jelly samples were prepared with all levels of anthocynins were extracted from red onion peels by different solvents and synthetic color. Color and overall acceptability of glazing jelly prepared with 0.25% natural anthocyanins extracted from red onion peel by all solvents recorded closely score with synthetic color.

CONCLUSION

Natural anthocyanins color play very important role in determining the acceptability food for consumer. Furthermore, anthocyanins are very important in human nutrition and food colorants. The most important outcome of this study regarding the optimization of conventional anthocyanins extraction from Egyptian red onion peels, that appear as promising source of water soluble pigments (anthocyanins).For instant, to develop a sustainable process, extracts were obtained utilizing cheap solvents such as extraction by acidified ethanol was more efficient than other systems regarding the extraction yield of total anthocyanins. The highest stability anthocyanins extracted by both of acidified methanol and acidified ethanol was at 40 to 80ºCuntil holding time reached to 60 min, it could be noticed that anthocyanins extracted by both of acidified methanol and ethanol showed higher thermal stability at different temperatures that are required for several processing of different products. In addition, hard candy containing 0.3% natural anthocyanins extracted by acidified methanol and acidified ethanol , and glazing jelly containing 0.25% of natural anthocyanins extracted by the same solvents were given the highest score of color and overall acceptability similar with synthetic color . In general, consumer preparation has been that natural food colorant ingredient would be safer, healthful and considered as potential food colorants for preparing hard candy and glazing jelly.

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Table (1): Basic formulation of hard candy and glazing jelly samples

Hard candy		Glazing jelly	
Ingredients	**(%)**	**Ingredients**	**(%)**
Sucrose	48.48	Sucrose	35.85
Corn syrup	25.90	Water	54.35
Water	25.26	Corn syrup	9.06
Flavoring oil	0.21	Carragenan	0.38
Citric acid	0.15	Sorbic acid	0.08
		Potassium sorbate	0.13
		Calcium chloride	0.15

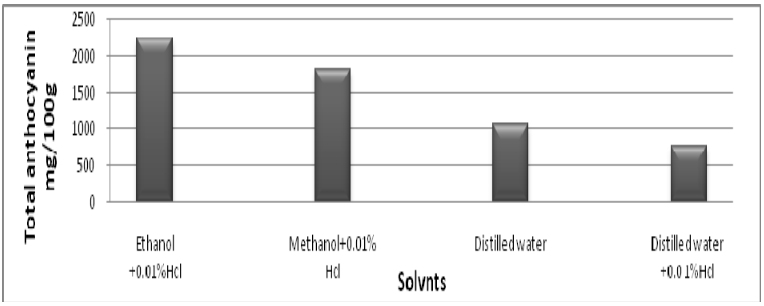


Fig (1): Total anthocyanins extracted from onion peels by different solvents

Table (2): Effect of pH values on retention rate of anthocyanins extracted from red onion peels by different solvents

pH values	**Retention (%)**			
	Acidified			**Distilled water**
	Methanol	**Ethanol**	**Distilled water**	
2	99.17[a]	96.55[a]	95.25[a]	94.76 [a]
3	96.64[b]	95.65[ab]	94.16[ab]	92.83[ab]
4	90.53[cb]	88.81[b]	87.47[b]	84.57[b]
5	84.22[c]	78.92[c]	77.41[c]	72.05[c]
6	73.40[e]	70.56[e]	65.00[e]	64.38[d]
7	69.28[f]	63.37[f]	56.26[f]	51.88[e]
8	78.98[d]	71.94[e]	68.20[de]	59.79[d]
9	83.04[c]	75.57[d]	71.83[d]	61.96[d]

Means in a raw showing the same letter are not significantly different (P ≥0.05)

Table (3): Effect of temperature on the retention rate of anthocyanins extracted from onion peel by different solvents

Treatments	Retention (%)			
	40 °c	60 °c	80 °c	100 °c
Methanol Hcl	99.16^{Aa}	98.79^{Aa}	91.56^{Ab}	69.45^{Ac}
Ethanol Hcl	99.15^{Aa}	98.01^{Aa}	86.68^{Bb}	66.22^{Bc}
Distilled water Hcl	99.11^{Aa}	95.49^{Ba}	85.83^{Bb}	60.92^{Cc}
Distilled water	98.62^{Aa}	94.91^{Ba}	79.63^{Cb}	55.80^{Dc}

Means values in same column showed the same superscript capital letters are not significantly different ($P \geq 0.05$)

Means values in same raw showed the same superscript small letters are not significantly different ($P \geq 0.05$)

Table (4): Thermal stability of anthocyanin extracted by methanol HCl from onion peels with different temperatures and times

Treatments	Temperatures	Retention (%)			
		30min	60min	90min	120min
Methanol 0.01%Hcl	40◦c	99.16^{Aa}	98.83^{Aa}	97.20^{Ab}	96.50^{Ab}
	60◦c	98.79^{Aa}	96.56^{Aab}	92.14^{Abc}	89.33^{Bc}
	80◦c	91.56^{Ba}	86.56^{Bab}	82.59^{Bbc}	78.79^{Cc}
	100◦c	69.45^{Ca}	64.19^{Cb}	54.83^{Cc}	45.67^{Dd}

Means values in same column showed the same superscript capital letters are not significantly different ($P \geq 0.05$)

Means values in same raw showed the same superscript small letters are not significantly different ($P \geq 0.05$)

Table (5): Thermal stability of anthocyanin extracted by ethanol Hcl from onion peels with different temperatures and times

Treatments	Temperatures	Retention (%)			
		30min	60min	90min	120min
Ethanol 0.01%Hcl	40◦c	99.15^{Aa}	98.63^{Aa}	96.74^{Aa}	93.80^{Aa}
	60◦c	98.01^{Aa}	95.15^{Aab}	89.96^{Abc}	87.25^{Ac}
	80◦c	86.68^{Ba}	81.94^{Ba}	77.09^{Bab}	68.16^{Bb}
	100◦c	66.22^{Ca}	56.81^{Cab}	42.17^{Cab}	39.47^{Cc}

Means values in same column showed the same superscript capital letters are not significantly different ($P<0.05$)

Means values in same raw showed the same superscript small letters are not significantly different ($P<0.05$)

Table (6): Thermal stability of anthocyanin extracted by distilled water Hcl from onion peels with different temperatures and times

Treatments	Temperatures	Retention (%)			
		30min	60min	90min	120min
Distilled water 0.01%Hcl	40◦c	99.11^{Aa}	98.57^{Aa}	95.87^{Ab}	94.84^{Ac}
	60◦c	95.49^{Aa}	92.04^{Aa}	87.93^{Aa}	86.76^{Aa}
	80◦c	85.83^{Ba}	77.93^{Ba}	68.54^{Bb}	67.64^{Bb}
	100◦c	60.92^{Ca}	44.77^{Cb}	40.66^{Cc}	31.17^{Cd}

Means values in same column showed the same superscript capital letters are not significantly different (P≥0.05)
Means values in same raw showed the same superscript small letters are not significantly different (P≥0.05)

Table (7): Thermal stability of anthocyanin extracted by distilled water from onion peels with different temperatures and times

Treatments	Temperatures	Retention (%)			
		30min	60min	90min	120min
Distilled water	40◦c	98.62^{Aa}	98.05^{Aa}	95.26^{Aab}	93.83^{Ab}
	60◦c	94.91^{Aa}	93.78^{Aab}	85.76^{Bbc}	83.71^{Bc}
	80◦c	79.63^{Ba}	66.23^{Bb}	53.69^{Cc}	49.29^{Cc}
	100◦c	55.81^{Ca}	36.52^{Cb}	35.62^{Db}	30.66^{Db}

Means values in same column showed the same superscript capital letters are not significantly different P≥0.05)
Means values in same raw showed the same superscript small letters are not significantly different (P≥0.05)

Table (8): Means scores of sensory properties of hard candy prepared with different levels of anthocyanin extracted from onion peels by different solvents.

Means scores of sensory properties					
Color					
Treatment	**Synthetic color**	**0.15 %**	**0.20 %**	**0.25 %**	**0.3 %**
Acidified methanol	8.3^{Abc}	7.1^{Ad}	8.1^{Ac}	8.7^{Aab}	9.0^{Aa}
Acidified ethanol	8.3^{Ab}	7.3^{Ac}	8.5^{Aab}	8.6^{Aab}	8.9^{Aa}
Acidified distilled water	8.3^{Aa}	7.4^{Ab}	7.9^{Aab}	8.2^{Aa}	8.2^{Ba}
Distilled water	8.3^{Aa}	7.3^{Ab}	8.5^{Aa}	8.5^{Aa}	8.1^{Ba}
Flavor					
Acidified methanol	8.5^{Aa}	8.4^{Aa}	8.5^{Aa}	8.5^{Aa}	8.4^{Aa}
Acidified ethanol	8.5^{Aa}	8.5^{Aa}	8.5^{Aa}	8.3^{Aa}	8.2^{Aa}
Acidified distilled water	8.5^{Aa}	8.4^{Aa}	8.4^{Aa}	8.4^{Aa}	8.3^{Aa}
Distilled water	8.5^{Aa}	8.5^{Aa}	8.5^{Aa}	8.5^{Aa}	8.4^{Aa}
Texture					
Acidified methanol	8.0^{Aa}	7.4^{Bb}	7.4^{Cb}	7.4^{Bb}	7.5^{Bab}
Acidified ethanol	8.0^{Aa}	8.1^{Aa}	7.9^{Ba}	8.0^{Aa}	8.0^{ABa}
Acidified distilled water	8.0^{Aa}	8.4^{Aa}	8.4^{Aa}	8.3^{Aa}	8.4^{Aa}
Distilled water	8.0^{Aa}	8.2^{Aa}	8.0^{ABa}	8.0^{Aa}	8.1^{ABa}
Clarity					
Acidified methanol	8.5^{Aa}	8.4^{Aa}	8.6^{Aa}	8.6^{Aa}	8.6^{Aa}
Acidified ethanol	8.5^{Aa}	8.6^{Aa}	8.7^{Aa}	8.7^{Aa}	8.5^{Aa}
Acidified distilled water	8.5^{Aa}	8.4^{Aa}	8.4^{Aa}	8.3^{ABa}	8.1^{Aa}
Distilled water	8.5^{Aa}	8.4^{Aab}	8.3^{Aab}	7.9^{Bb}	7.9^{Ab}
Mouth feel					
Acidified methanol	8.1^{Aa}	7.5^{Bb}	8.0^{Aa}	8.1^{Aa}	8.4^{Aa}
Acidified ethanol	8.1^{Aa}	7.6^{Bb}	8.1^{Aa}	8.2^{Aa}	8.2^{Aa}
Acidified distilled water	8.1^{Aa}	8.2^{Aa}	8.1^{Aa}	8.2^{Aa}	8.0^{Aa}
Distilled water	8.1^{Aa}	7.4^{Bb}	8.1^{Aa}	8.2^{Aa}	8.2^{Aa}
Overall acceptability					
Acidified methanol	8.5^{Ab}	7.7^{Bc}	$8.6^{A\ ab}$	8.7^{Aab}	8.9^{Aa}
Acidified ethanol	8.5^{Aa}	7.7^{Bb}	8.4^{Aa}	8.5^{Aa}	8.7^{Aa}
Acidified distilled water	8.5^{Aab}	8.3^{Ab}	8.2^{Aab}	8.5^{Aa}	7.9^{Bb}
Distilled water	8.5^{Aa}	7.7^{Bb}	8.5^{Aa}	8.5^{Aa}	8.1^{Bab}

Means values in same column showed the same superscript capital letters are not significantly different (P≥0.05)

Means values in same raw showed the same superscript small letters are not significantly different (P≥0.05)

Synthetic color 0.15% 0.2% 0.25% 0.30%

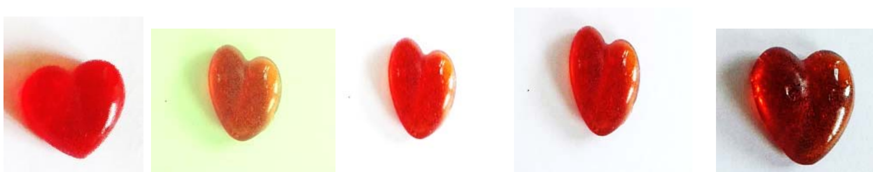
Acidified methanol

Synthetic color 0.15% 0.2% 0.25% 0.30%

Acidified ethanol

Synthetic color 0.15% 0.2% 0.25% 0.30%

Distilled water Hcl



Synthetic color 0.15% 0.2% 0.25% 0.30%

Distilled water

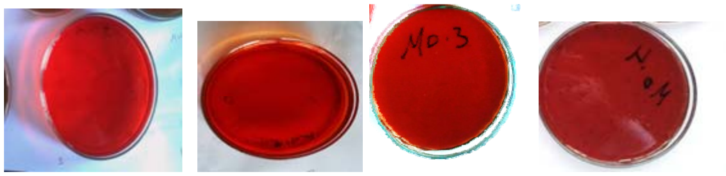
Fig.(2): Hard candy prepared with deferent levels of anthocyanins were extracted from red onion peel by different solvents

Table (9): Means scores of sensory properties of glazing jelly prepared with different levels of anthocyanin extracted from onion peels by different solvents.

Means scores of sensory properties				
Color				
Treatment	**Synthetic color**	**0.2 %**	**0.25 %**	**0.3 %**
Acidified methanol	8.6^{Aa}	8.1^{Ab}	8.7^{Aa}	8.4^{Aab}
Acidified ethanol	8.6^{Aa}	7.7^{Ab}	8.5^{Aa}	8.3^{Aa}
Acidified distilled water	8.6^{Aa}	7.8^{Ab}	8.4^{Aab}	8.1^{Aab}
distilled water	8.6^{Aa}	8.1^{Aa}	8.6^{Aa}	8.5^{Aa}
Flavor				
Acidified methanol	8.8^{Aa}	8.9^{Aa}	8.6^{Aa}	7.7^{BCb}
Acidified ethanol	8.8^{Aa}	8.8^{Aa}	7.8^{Bb}	7.2^{Cc}
Acidified distilled water	8.8^{Aa}	8.6^{Aa}	8.5^{Aa}	8.2^{ABa}
distilled water	8.8^{Aa}	8.7^{Aa}	8.6^{Aa}	8.6^{Aa}
Texture				
Acidified methanol	8.6^{Aa}	8.5^{Aa}	8.5^{Aa}	8.5^{Aa}
Acidified ethanol	8.6^{Aa}	8.5^{Aa}	8.5^{Aa}	8.5^{Aa}
Acidified distilled water	8.6^{Aa}	8.6^{Aa}	8.6^{Aa}	8.4^{Aa}
distilled water	8.6^{Aa}	8.7^{Aa}	8.7^{ABa}	8.6^{Aa}
Clarity				
Acidified methanol	8.9^{Aa}	8.9^{Aa}	8.8^{Aab}	8.4^{Ab}
Acidified ethanol	8.9^{Aa}	8.8^{Aa}	8.2^{Bb}	8.1^{Ab}
Acidified distilled water	8.9^{Aa}	8.9^{Aa}	8.4^{ABab}	7.9^{Ab}
distilled water	8.9^{Aa}	8.7^{Aa}	8.4^{ABab}	8.0^{Ab}
Grainess				
Acidified methanol	8.8^{Aa}	8.8^{Aa}	8.8^{Aa}	8.5^{Aa}
Acidified ethanol	8.8^{Aa}	8.8^{Aa}	8.8^{Aa}	8.5^{Aa}
Acidified distilled water	8.8^{Aa}	8.5^{Aa}	8.4^{Aa}	8.3^{Aa}
distilled water	8.8^{Aa}	8.7^{Aa}	8.8^{Aa}	8.8^{Aa}
Overall acceptability				
Acidified methanol	8.9^{Aa}	8.8^{Aa}	8.7^{Aa}	8.0^{Bb}
Acidified ethanol	8.9^{Aa}	8.6^{Aa}	8.5^{Aa}	7.6^{Bb}
Acidified distilled water	8.9^{Aa}	8.4^{Aa}	8.8^{Aa}	8.6^{Aa}
distilled water	8.9^{Aa}	8.3^{Ab}	8.9^{Aa}	8.5^{Aab}

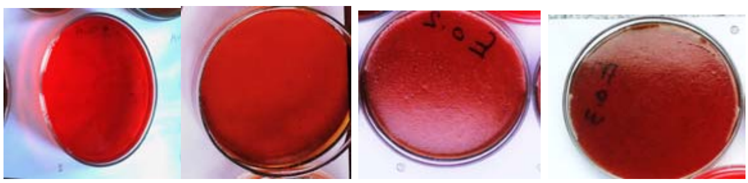
Means values in same column showed the same superscript capital letters are not significantly different (P≥0.05)

Means values in same raw showed the same superscript small letters are not significantly different (P≥0.05)



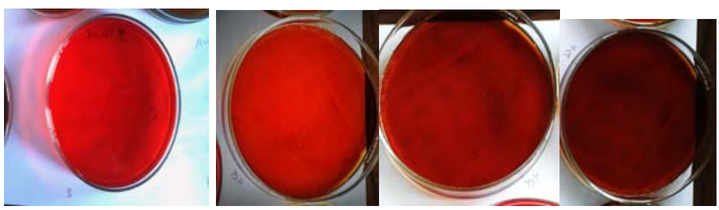
Synthetic color 0.2% 0.25% 0.30%

Acidified methanol



Synthetic color 0.2% 0.25% 0.30%

Acidified ethanol



Synthetic color 0.2% 0.25% 0.30%

Acidified Distilled water

Synthetic color 0.2% 0.25% 0.30%

Distilled water

Fig.(3) : Glazing jelly prepared with deferent levels of anthocyanins were extracted from red onion peel by different solvent

تأثير طرق الإستخلاص المختلفة على ثبات الأنثوسيانين المستخلص من قشور البصل الأحمر وإستخدامه كملون للأغذية

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الملخص العربي:

أجريت هذه الدراسة بهدف الحصول على صبغة الأنثوسيانين من قشور البصل الأحمر(*Allium cepa*) عن طريق إستخلاص هذه الصبغة بإستخدام أربعة مذيبات عضوية مختلفة وإستخدامها فى بعض الأغذية ؛ وأظهرت النتائج أن كحول الإيثانول المعامل بحامض الهيدروكلوريك (0.01%) كان الأكثر كفاءة فى الإستخلاص ويليه كحول الميثانول المعامل بحامض الهيدروكلوريك (0.01%) , بينما الإستخلاص بالماء المقطر المعامل بالحامض وغير المعامل بالحامض كانا الأقل كفاءة. وأظهرت النتائج أن الأنثوسانين الطبيعى كان أعلى ثباتا عند قيم pH تراوحت من 2.0 الى 3.0 . تم دراسة تأثير المعاملة الحرارية على ثبات الصبغة المستخلصة من قشور البصل الأحمر وأظهرت النتائج إحتفاظها بتركيزات مرتفعة وصلت الى 99.16, 98.79 , 91.56, 69.45 % للصبغة المستخلصة بكحول الميثانول المعامل بحامض الهيدروكلوريك بينما كانت 99.15, 98.01, 86.68, 66.22% للصبغة المستخلصة بكحول الإيثانول المعامل بحامض الهيدروكلويك بعد تسخين لمدة 30 دقيقة على درجات حرارة 40, 60, 80, 100°م على التوالى ، وقد أظهرت النتائج الثبات العالى للأنثوسيانين المستخلصة من قشور البصل الأحمر بكلا من الميثانول والإيثانول عند درجات حرارة من 40 الى 80 °م حتى فترة زمنية 60 دقيقة . وقد سجل اللون والقبول العام للحلوى الصلبة عند تركيز 0.3% أنثوسيانين طبيعى مستخلص من قشور البصل الأحمر بالميثانول المعامل بالحامض درجات أعلى من اللون الصناعى (الألورا) ومن جانب أخر سجل جيلى التغطية عند تركيز 0.25% أنثوسيانين طبيعى مستخلص من قشور البصل الأحمر بالمذيبات المختلفة درجات قريبة من اللون الصناعى .

الكلمات المفتاحية: قشور البصل الاحمر، الوان طبيعيه، الانثوسانين ، استخلاصه، ثباته، استخدامه