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Studying Physicochemical Properties of Sardasht Red Grape Skin Encapsulated Extract and Stability Evaluation of These Compounds in Yoghurt

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Abstract

Sardasht's red grape (*Vitis Viniferae cv. Rash*) skin is one of the most abundant wastes found in juice factories annually and is a rich source of bioactive compounds. In this research after preparing the extract with ethanol-chloride-acid solution from the skin of Sardasht's red grape, the bioactive compounds were determined using high performance liquid chromatography (HPLC). The results showed the highest amount of phenolic compounds were for gallic acid then catechin, salicylic acid and vanillic acid. The highest levels of anthocyanins were Petunidin 3-o-glucopyranoside and Peonidin 3-o-glucoside chloride. Microencapsulation of the skin of Sardasht's red grape extracted is done by maltodextrins and Arabic gum with ratios of 50-50, 75-25. The experiments were carried out, including moisture content, water activity, solubility, anthocyanin, phenolic compounds and antioxidant activity. According to the results, The powder obtained from the microencapsulation of the sample with maltodextrin and Arabic gum (50-50) with the highest phenolic compounds and antioxidant activity were selected and used in yoghurt (0.3-0.6) with tannic acid (1% by weight). Phenolic compounds, anthocyanins, antioxidant activity level of our samples during the 21 days of storage were investigated. The results showed that the most amounts of anthocyanin and phenolic compounds and antioxidant activity were observed in yoghurt with 0.6% powder with tannic acid. Significant increase in phenolic compounds, anthocyanins and antioxidant activity of yogurt containing encapsulated powder were observed compared to control yogurt. The results showed that red grape's skin extract and powder can be used in functional food formulations.

Keywords: Arabic gum, HPLC, Maltodextrine, Microencapsulation, Sardasht's red grape

Introduction

Grape pomace is a lignocellulose waste and the solid remains of grape juice processing. 20% of wet grape pomace is composed of grape pomace (Mahdavi *et al*., 2004). Grape pomace contains polyphenols (mainly anthocyanins, flavonols, flavanols, phenolic acids and Resveratrol)

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and citric acid (Pourali *et al*., 2014). In this research, after producing the extract of Sardasht red grape flesh, the bioactive compounds were identified, and after microcapsulation and powder production by spray drying, the usability and durability potential of microcapsulated powder in yogurt were measured.

Material and methods

First, Sardasht red grapes (Vitis Vintiferae cv. Rash) were obtained from Urmia Pakdis juicer Factory. After washing, the grape was dried with vaccum oven and grinded then mixed with ethanol- hydrochloric acid, was sonicated at temperature 55 ℃ and times15 min in an ultrasonic bath, the working frequency was fixed at 35 kHz (Rajaei *et al*., 2010). Total phenolic contents of this extract were determined using the Folin–Ciocalteau method (Shahidi & Naczk, 2004). Evaluating the antioxidant activity of the extract by DPPH was monitored according to the method explained by (Galvez *et al*., 2007). Measurement of anthocyanin by pH differential method introduced by Fuleki & Fransis (1968). Identification of major bioactive compounds was carried by High Performance Liquid Chromatography (Barreca *et al*., 2016).

Finally to micro-encapsulation of the bioactive compounds of Sardasht red grape extract with various amounts of maltodextrin and Arabic gum, ratios of 50-50, 75 to 25 w/w were done according to the results of other investigations and according to the preliminary tests (Sharifi *et al*., 2015).The characteristics of micro-coating powder including moisture content (AOAC, 1990), water activity and solubility (AOAC, 1990) were investigated.

Production of yogurt containing extracts and microencapsulated powder of Sardasht red grape was done according to the proposed method of Tamime & Robinson (1999). Concentrated extract of red grapes with brix 27 and microencapsulated powder of Sardasht red grape were added to 0.3% and 0.6% w/w to production yogurt. Tannic acid was used as a 1 wt% for anthocyanin stability in the yogurt (Bordignon *et al*., 2006). The sampels were kept 21 days for evaluation some physicochemical properties, determination of anthocyanin content (Fuleki & Fransis, 1968), total phenolics content (Shahidi & Naczk, 2004), antioxidant activity (Galvez *et al*., 2007) and synersis that was done according to Zainoldin & Baba (2009) method.

Statistical analysis was performed by SAS software and Duncan's comparison was done at the level of 5% to compare mean scores and charts were drawn using Excel 2007 software.

Results and discussion

Identification of phenolic and anthocyanin compounds of red Sardasht grape extract with high performance liquid chromatography

At optimal extraction with ultrasound at 55 ℃ and time of 15 min, the anthocyanin content of the extract was 121.65 mg/mL, phenolic compounds 115.14 mgGAL/100mL, and the antioxidant activity of extract was 64.88%. Table (1) displays the phenolic and anthocyanin compounds found in the extract of Sardasht red grape flesh.

Table 1. Phenolic and anthocyanin compounds existing in extracts of Sardasht red grape flesh.

Phenolic componds	ppm rate
Galic asid	150.1±0.06
Catechin	42.2±0.04
Vanillic acid	5±0.01
Salicylic acid	10±0.02
Petunidin 3-o glucopyranoside	94.23±0.06
Peonidin 3-o-glucoside chloride	696±0.02

Investigation of microcapsulated powder of Sardasht red grape extract characteristics

The moisture content of two samples of microcapsulated powder of Sardasht red grape extract

was compared, there was no significant difference between two samples ($P\geq0.05$). The highest solubility was observed in the sample 50:50 maltodextrin and gum arabic (85%) that has statistically significant difference with the sample 25:75 (80%) ($P\leq0.05$).The results of antioxidant activity changes showed that there was no significant difference between the two samples ($P\geq0.05$). The ratio of maltodextrin and Arabic gum had no significant effect on the content of phenolic compounds of the two studied samples. The microcapsulated sample with a maltodextrin-to- gum arabic ratio of 50:50 showed more phenolic compounds (102.89 mgGAL/100mL) compared to 25:75 (96.11 mgGAL/100mL). The evaluation results of the total anthocyanins content of the two tested samples revealed that the maximum amount of anthocyanins in the microcapsulated sample with a maltodextrin-to-gum arabic ratio of 50:50 was observed to be 109.89 mg/mL, which has significant difference ($P\leq0.05$) with the microcapsulated sample with a maltodextrin-to-gum arabic ratio of 75:25, (98.73 mg/mL). In this study, microcapsulated sample with a maltodextrin-to-gum arabic ratio of 50:50 had a higher water activity (0.156) compared to the other sample (0.123) ($P\leq0.05$).

Investigation of physicochemical characteristics of yogurt containing extract and microcapsulated powder of Sardasht red grape extract

The results showed that the application of microcapsulated powder in retention of anthocyanin content was effective. The highest amount of anthocyanins was observed in samples containing microcapsulated powder, which showed a statistically significant difference with yoghurt containing the extract ($P\leq0.05$). The content of anthocyanins during the storage of yoghurt samples was significantly decreased ($P\leq0.05$). The highest amount was observed in yoghurt samples containing 0.6% of microcapsulated powder with tannic acid at the first day of product (8.94 mg/mL).

The highest and lowest content of phenolic compounds was observed in yoghurt samples containing 0.6% tannic acid microcapsulted powder on 7st day (35.25 mgGAL/100mL) and control yoghurt samples respectively. Yogurt samples containing 0.3% extract of Sardasht red grape (13.28 GAL/100mL) on 21st day of storage after the control sample contained the lowest amount of phenolic compounds. All samples had statistically significant difference in terms of phenolic compounds ($P\leq0.05$). The effectiveness of the microcapsulation process as well as the use of tannic acid in retention of phenolic compounds during yogurt storage period was confirmed with these results. The amount of phenolic compounds decreased with the increase in yogurt storage time and the lowest amount was observed on 21st day of storage.

Yogurt samples containing 0.6% of the microcapsulated powder with tannic acid on 7th day contained the highest levels of antioxidant activity (47.26%) in compared with yogurt containing 0.6% of microcapsulated powder had no significant difference, but had a statistically significant difference with other treatments ($P\leq0.05$). The lowest level of antioxidant activity was observed in the control sample.

The control sample had the highest rate of synersis ($P\leq0.05$). The lowest rate of synersis was observed in yoghurt samples containing 0.6% microcapsulated powder with tannic acid. Probably the increase in the amount of the solid content has been effective in decreasing of synersis ($P\leq0.05$). Over time, the amount of synersis was significantly increased, and the highest amount of synersis was observed on 21st day of storage. The lowest amount of synersis was observed in yogurt samples containing 0.6% microcapsulated powder with tannic acid on the first day of storage, and the highest amount was observed in the control sample on the 21st day of storage.

Conclusion

Results showed the highest amount of phenolic compounds were for gallic acid then catechin, salicylic acid and vanillic acid. The highest levels of anthocyanins were Petunidin 3-

oglucopyranoside and Peonidin 3-o-glucoside chloride. The microcapsulation results revealed that the produced powder samples with the equal ratio of maltodextrin to Arabic gum contained the most bioactive compounds. The results of stability of the extract bioactive compounds in yogurt indicated that the most amounts of anthocyanin, phenolic compounds and antioxidant activity are observed in yoghurt with 0.6% powder with tannic acid. Significant increase in phenolic compounds, anthocyanins and antioxidant activity of yogurt containing encapsulated powder were observed compared to control yogurt. Results showed that we can use red grape skin extract and powder in functional food formulations.

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References

AOAC. (1990). *Official method of analysis. Arlington*, USA: Association of Official Analytical Chemists. N: 934.06.

Barreca, D., Laganà, G., Leuzzi, U., Smeriglio, A., Trombetta, D., & Bellocco, E. (2016). Evaluation of the nutraceutical, antioxidant and cytoprotective properties of ripe pistachio (*pistacia vera* L., variety bronte) hulls. *Food Chemistry, 196*, 493-502. doi:https://doi.org/10.1016/j.foodchem.2015.09.077

Bordignon-Luiz, M.T., Gauche, C., Gris, E.F., & Falcao, L.D. (2006). Colour stability of anthocyanin from Isabel grape in model systems. *LWT-Food Science and Technology, 40*(4), 594-599. doi:https://doi.org/10.1016/j.lwt.2006.02.022

Fuleki, T., & Francis, F.J. (1968). Quantitative methods for anthocyanins, determination of total anthocyanin and degradation index for cranberry juice. *Journal of Food Science, 33*, 78-83. doi:https://doi.org/10.1111/j.1365-2621.1968.tb00888.x

Galvez, A., Di Scala, K., Rodriguez, K., Mondaca, R.L., Miranda, M., Lopez, J., & Perez-Wan, M. (2007). Effect of air-drying temperature on physico-chemical properties, antioxidant capacity, colour and total phenolic content of red pepper (*capsicum annuum*, L. var. hungarian). *Journal of Food Chemistry, 117*(4), 647-653. doi:https://doi.org/10.1016/j.foodchem.2009.04.066

Mahdavi, H., & Zanjirian, A. (2004). Investigation of the state of recycling and production of valuable substances from unused agricultural products and related industry. Research project of Engineering Research Center of Jahad Keshavarzi, Tehran. (in Persian)

Pourali, A., Afrouziyeh, M., & Moghaddaszadeh-ahrabi, S. (2014). Extraction of phenolic compounds and quantification of the total of grape pomace. *European Journal of Experimental Biology, 4*(1), 174-176.

Rajaei, A., Barzegar, M., Hamidi, Z., & Sahari, M.A. (2010). Optimization of extraction conditions of phenolic compounds from pistachio (*pistachia vera*) green hull through response surface method. *Agriculture Science Technology, 12*(10), 605-615.

Shahidi, F., & Naczk, M. (2004). *Phenolics in food and nutraceuticals*. Boca Raton, FL: CRC Press.

Sharifi, A., Niakousari, M., Maskooki, A. & Mortazavi, S.A. (2015). Effect of spray drying conditions on the physicochemical properties of barberry *(berberis vulgaris)* extract powder. *International Food Research Journal, 22*(9), 2364-2370.

Tamime, A.Y., & Robinson, R.K. (1999). *Yogurt science and technology*, (pp, 365-373): woodhead publishing, New Yourk.

Zainoldin, K.H., & Baba, A.S. (2009). The effect of hylocereus polyrhizus and hylocereus undatus on physicochemical, proteolysis and antioxidanat activity in yogurt. *World Academy of science, Engineering and Technology, 60*, 361-366.