ISSN: 0975 -8542

Journal of Global Pharma Technology

Available Online at: www.jgpt.co.in

RESEARCH ARTICLE

Possibility of Herbal Tea Production from Corn Silk (*Zea mays*)

Nguyen Phuoc Minh

Academic Department, Binh Duong University, Thu Dau Mot City, Binh Duong Province, Vietnam.

Abstract

Corn silk is usually discarded as waste. It has a great medicinal importance due to the presence of valuable bioactive phytochemical compounds. It's believed to be nontoxic and safe for human. Among various parts of corn, the corn silk is a rich source of antioxidant components and possesses strong antioxidant potential. It could be utilized as herbal tea like a healthy beverage. Objective of this study focused on the effect of blanching temperature and time; vacuum drying temperature and pressure to anthocyanin (mg/L), flavonoid (µg RE/g) and overall acceptance (sensory score) of the dried corn silk tea. Results showed that corn silk should be blanched in hot water 95°C at 10 seconds in the present of $CaCl_2$ 1.5% and then being dried by vacuum dryer at 45°C, -0.8 bar for 4 hours to get the final moisture content 8% available for preservation. It's considered as a suitable raw material for production of functional food.

Keywords: *Corn silk, Blanching, Vacuum drying, Herbal tea, Anthocyanin, Flavonoid.*

Introduction

Corn silk has been seen as waste and by product from fresh corn production [1]. It's collected before the plant is pollinated [2]. Corn silk has been traditionally utilized as herb for the treatment of various diseases notably hypercholesterolemia, urinary infections [3, 5]. It has antioxidant, anti-hyperglycemic, anti-diabetic, antiproliferative, antihyperlipidemic, antimutagenic, anticoagulant, uricosuric, antifungal, antiadipogenic, antiobesitic, neuroprotective antihypertensive, antihyperlipidemic, diuretic, antilithiatic, antibiotic, hepatoprotective, antibacterial, antiseptic, anti-inflammatory, antidepressant, antitumor, and anti-fatigue activities [6, 11].

It could be consumed as a functional beverage [12]. It contains low moisture, fat but high protein, ash, dietary fiber, carbohydrates, vitamins and minerals [13, 15]. Corn silk contains a number of bioactive phytochemical compounds including phenols, polyphenols, phenolic acids, flavonoids, flavone glycosides, anthocyanins, carotenoids, terpenoids, alkaloids, steroids, luteins, tannins, saponins, volatile oils, vitamins, some sugars, and polysaccharides [3, 4, 16].

It's a good choice as functional food or medicine for the treatment of type 2 diabetes mellitus due to its hypoglycemic activity [17]. Pupose of our study focused on the utilization of corn silk as a potential material for the functional herbal tea production.

Material and Method

Material

Corn silk was collected at 18-20 days after flowering in Bac Lieu province, Vietnam. After collecting, they must be quickly conveyed to laboratory for experiments. Chemical substances and reagents such as aluminum chloride, rutin hydrate, methanol, HCl were all analytical grade supplied from Rainbow Trading Co. Ltd., Vietnam.

Researching Procedure

Effect of Blanching Temperature and Time to Anthocyanin (mg/L), Flavonoid (mg/g) and Overall Acceptance (Sensory Score) in the Dried Corn Silk Tea

Raw corn silks were blanched in water solution with 1.5% $CaCl_2$ at different temperature and time (100°C, 5 second; 95°C, 10 seconds; 90°C, 15 seconds; 85°C, 20 seconds).

Then they were dripped and dried by vacuum dryer at 35°C, -0.2 bars for 4 hours. All samples were dried at 55°C, -0.2 bar by vacuum dryer. Then they were analyzed anthocyanin (mg/L), flavonoid (µg RE/g), overall acceptance (sensory score) to define the suitable blanching formula.

Effect of Vacuum Drying Temperature and Pressure to Anthocyanin (mg/L), Flavonoid (mg/g) and Overall Acceptance (Sensory Score) in the Dried Corn Silk Tea

Raw Corn silks were blanched in hot water with 1.5% $CaCl_2$ at 95°C in 10 seconds. Then these samples would be dripped and dried under vacuum dryer at different temperature (35°C, 40°C, 45°C, 50°C, 55°C) and different pressure (-0.2, -0.4, -0.6, -0.8, -1.0 bar) for 4 hours. All samples were analyzed anthocyanin (mg/L), flavonoid (µg RE/g), overall acceptance (sensory score) to define the optimal drying condition.

Chemical, Sensory and Statistical Analysis

Anthocyanin (mg/l) content was determined according to the pH-differential method [18]. Flavonoid (µg RE/g) was determined was determined using a modified colorimetric aluminum chloride method [8]. Overall acceptance (sensory score) of corn silk was assessed by a group of 11 panelists. They were required to estimate the overall acceptance using the 9-point Hedonic scale. The experiments were run in triplicate with three different lots of samples. Statistical analysis was performed by the Stat graphics Centurion XVI.

Result & Discussion

Effect of Blanching Temperature to Anthocyanin (mg/L), fLavonoid (µg RE/g) and Overall Acceptance (Sensory Score) in the Dried Corn Silk Tea

Phenolic compounds are the most important phytochemicals in corn silk which flavonoids and anthocyanins are the most common groups [1]. Corn silk is an excellent source of many bioactive compounds, especially for flavonoid compounds [19]. Flavonoids are the bioactive phytochemical constituents which make the plant resistant to the attack of microbes, insects and also protect the animals against various diseases [16, 20, 21]. Flavonoids possess strong antioxidant activity and free radical-scavenging capacity and inhibit protein glycation [20, 22, 23].

Flavonoids were found at the highest concentration in corn silk [24]. Raw corn silks were blanched in hot water with 1.5% $CaCl_2$ at different temperature and time (100°C, 5 second; 95°C, 10 seconds; 90°C, 15 seconds; 85°C, 20 seconds). All samples were dried at 55°C, -0.2 bar by vacuum dryer. Then they were analyzed anthocyanin (mg/L), flavonoid (µg RE/g), overall acceptance (sensory score) to validate the appropriate blanching condition. Results were mentioned in Table 1. From table 1, the corn silk should be blanched at 95°C in 10 seconds to maintain the most phytochemical constituents and overall acceptance in the dried corn silk tea. It is very important for use of the alternative natural source of flavonoids from corn silk.

Table 1: Effect of blanching temperature to anthocyanin (mg/L), flavonoid (µg RE/g) and overall acceptance (sensory score) in the dried corn silk tea

Blanching	Anthocyanin (mg/L)	Flavonoid (µg RE/g)	Sensory score
100°C, 5 seconds	22.48±0.00^{b}	0.71±0.01^{b}	7.03±0.00^{b}
95°C, 10 seconds	24.75±0.03^{a}	0.94±0.00^{a}	7.41±0.01^{a}
90°C, 15 seconds	17.42±0.02^{c}	0.61±0.03^{bc}	6.12±0.02^{c}
85°C, 20 seconds	14.08±0.01^{d}	0.50±0.02^{c}	5.24±0.03^{d}

Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant (α = 5%)

Effect of Vacuum Drying Temperature and Pressure to Anthocyanin (mg/L), Flavonoid (µg RE/g) and Overall Acceptance (Sensory Score) in the Dried Corn Silk Tea

Anthocyanins constitute the largest and probably the most important group of water-soluble natural pigments and these compounds are unique among flavonoids as their structures undergo reversible transformation at different pH in aqueous solution [25]. Anthocyanins are the flavonoid compounds that are produced in corn silk. Drying is an important unit operation to stabilize corn silk for the utilization as herbal medicine. The higher dried yield leads to the more economic production [1]. Raw corn silks

were blanched in hot water with 1.5% $CaCl_2$ at 95°C in 10 seconds. Then these samples would be dried by vacuum dryer at different temperature (35°C, 40°C, 45°C, 50°C, 55°C) and different pressure (-0.2, -0.4, -0.6, -0.8, -1.0 bar). All samples were analyzed anthocyanin (mg/L), flavonoid (µg RE/g), overall acceptance (sensory score) to validate the appropriate drying temperature and pressure. Results were mentioned in table 2 and 3. From Table 2 and 3, the corn silk should be dried at 45°C, -0.8 bars to maintain the most anthocyanin (mg/L), flavonoid (µg RE/g) and overall acceptance in the dried corn silk tea.

Table 2: Effect of drying temperature (°C) at -0.2 bar pressure to anthocyanin (mg/L), flavonoid (µg RE/g) and overall acceptance (sensory score) in the dried corn silk tea

Drying temperature (°C)	Anthocyanin (mg/L)	Flavonoid (µg RE/g)	Sensory score
35	27.08±0.02^{a}	1.32±0.01^{a}	8.11±0.03^{a}
40	27.05±0.00^{a}	1.30±0.00^{a}	8.08±0.02^{a}
45	27.03±0.03^{a}	1.29±0.03^{a}	8.06±0.00^{a}
50	25.27±0.00^{ab}	1.15±0.01^{ab}	7.84±0.03^{ab}
55	24.75±0.03^{b}	0.94±0.00^{b}	7.41±0.01^{b}

Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant (α = 5%)

Table 3: Effect of drying pressure (bar) at 45°C to anthocyanin (mg/L), flavonoid (µg RE/g) and overall acceptance (sensory score) in the dried corn silk tea

Drying pressure (bar)	Anthocyanin (mg/L)	Flavonoid (µg RE/g)	Sensory score
-0.2	27.03±0.03^{c}	1.29±0.03^{b}	8.06±0.00^{b}
-0.4	28.35±0.01^{b}	1.42±0.02^{ab}	8.24±0.02^{ab}
-0.6	29.14±0.00^{ab}	1.51±0.00^{ab}	8.45±0.00^{ab}
-0.8	30.08±0.02^{a}	1.62±0.01^{a}	8.76±0.03^{a}
-1.0	30.11±0.01^{a}	1.63±0.03^{a}	8.80±0.01^{a}

Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant (α = 5%)

Conclusion

Corn silk highly contains polyphenols, phenolic acids, flavonoids, anthocyanins, glycosides, carotenoids, polysaccharides of biological constituents, reducing compounds and water-soluble vitamins. It has been used for the treatment of several ailments due to various pharmacological activities exhibited by its extracts. Corn silk is also known to be urine laxative, antihypertensive, and immune enhancer. Corn silk tea has been used as diuretic for the treatment of urinal irritation. It has a great attention owing to a variety of bioactive phytochemical compounds. We have successfully found out some major technical factors affecting to production of dried corn silk herbal tea via blanching and vacuum drying. Utilization of corn silk for commercial production of functional food is worth-exploring to convert waste agricultural products into value-added products.

References

1. Sarepoua E, Tangwongchai R, Suriharn B, Lertrat K (2013) Relationships between phytochemicals and antioxidant activity in corn silk. International Food Research Journal, 20: 2073-2079.
2. Maksimovic Z, Malencic D, Kovacevic N (2005) Polyphenol contents and antioxidant activity of Maydis stigma extracts. Bioresource Technology, 96: 873-877.
3. Ebrahimzadeh MA, Pourmorad F, Hafezi S (2008) Antioxidant activities of Iranian corn silk. Turkish Journal of Biology, 32: 43-49.
4. Hasanudin K, Hashim P, Mustafa S (2012) Corn silk (Stigma maydis) in healthcare: A phytochemical and pharmacological review. Molecules, 17: 9697-9715.
5. Karami M, Shokerzadeh M, Naghshvar F, Ala S, Fezbakhsh R, Nosrati A (2018) Comparison the renal protective activity of corn silk and Feijoa extracts by using insitu rat renal perfusion system. Iranian Journal of Toxicology, 8: 25.
6. Kim KA, Choi S-K, Choi H-S (2004) Corn silk induces nitric oxide synthase in murine macrophages. Experimental and Molecular Medicine, 36: 545.
7. Kim KA, Shin H-H, Choi SK, Choi H-S (2005) Corn silk induced cyclooxygenase-2 in murine macrophages. Bioscience,

Biotechnology, and Biochemistry, 69: 1848-1853.

8. Liu J, Wang C, Wang Z, Zhang C, Lu S, Liu J (2011) The antioxidant and free-radical scavenging activities of extract and fractions from corn silk (Zea mays L.) and related flavone glycosides. Food Chemistry, 126: 261-269.
9. Hu QL, Deng ZH (2011) Protective effects of flavonoids from corn silk on oxidative stress induced by exhaustive exercise in mice. African Journal of Biotechnology, 10: 3163-3167.
10. Min O-J, Sharma BR, Park C-M, Rhyu D-Y (2011) Effect of myadis stigma water extract on adipogenesis and blood glucose in 3T3-L1 adipocytes and db/db mice. Korean Journal of Pharmacognosy, 42: 201-208.
11. Chen G, Wang H, Zhang X, Yang S-T (2014) Nutraceuticals and functional foods in the management of hyperlipidemia. Critical Reviews in Food Science and Nutrition, 54: 1180-1201.
12. Chen S, Chen H, Tian J, Wang Y, Xing L, Wang J (2013) Chemical modification, antioxidant and α-amylase inhibitory activities of corn silk polysaccharides. Carbohydrate Polymers, 98: 428-437.
13. Nuss ET, Tanumihardjo SA (2010) Maize: A paramount staple crop in the context of global nutrition. Comprehensive Reviews in Food Science and Food Safety, 9: 417-436.
14. Emmanuel SA, Olajide O, Abubakar S, Akiode SO, Etuk-Udo G (2016) Chemical evaluation, free radical scavenging activities and antimicrobial evaluation of the methanolic extracts of corn silk (Zea mays). Journal of Advances in Medical and Pharmaceutical Sciences, 9: 1-8.
15. Jana ŽS, Janković M, Basić Z, Vančetović J, Maksimović V (2016) Antioxidant activity, phenolic profile, chlorophyll and mineral matter content of corn silk (Zea mays L): Comparison with medicinal herbs. Journal of Cereal Science, 69: 363-370.
16. Guevara P, Perez-Amador MC, Zuniga B, Snook M (2000) Flavones in corn silks & resistance to insect attacks. Phyton, 69: 151-156.
17. Pan Y, Wang C, Chen Z, Li W, Yuan G, Chen H (2017) Physicochemical properties and antidiabetic effects of a polysaccharide from corn silk in high-fat diet and streptozotocininduced diabetic mice. Carbohydrate Polymers, 164: 370-378.
18. Ku KM, Kin SK, Kang YH (2009) Antioxidant activity and functional compound of corn silk (Zea mays L.). Korean Journal of Plant Research, 22: 323-329.
19. Ren SC, Liu ZL, Ding XL (2009) Isolation and identification of two novel flavone glycosides from corn silk (Stigma maydis). Journal of Medicinal Plants Research, 3: 1009-1015.
20. Silva MM, Santos MR, Caroço G, Rocha R, Justino G, Mira L (2002) Structure-antioxidant activity relationships of flavonoids: A re-examination. Free Radical Research, 36: 1219-1227.
21. Nessa F, Ismail Z, Mohamed N (2012) Antimicrobial activities of extracts and flavonoid glycosides of corn silk (Zea mays L). International Journal of Biotechnology for Wellness Industries, 1: 115-120.
22. Matsuda H, Wang T, Managi H, Yoshikawa M Structural requirements of flavonoids for inhibition of protein glycation and radical scavenging activities. Bioorganic and Medicinal Chemistry, 11: 5317-5323.
23. Wu C-H, Yen G-C (2005) Inhibitory effect of naturally occurring flavonoids on the formation of advanced glycation endproducts. Journal of Agricultural and Food Chemistry, 53: 3167-3173.
24. Hu, QL Zhang, LJ Li, YN Ding, YJ Li FL (2010) Purification and anti-fatigue activity of flavonoids from corn silk. International Journal of Physical Sciences, 5: 321-326.
25. Jian H, Monica GM (2010) Anthocyanins: natural colorants with health-promoting properties. Annual Review of Food Science and Technology, 1: 63-87.

