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Quality Characteristics of Dried Coriander Leaves: A Review

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A B S T R A C T

Coriander (*Coriandrum sativum* L.) leaves are the most common and one of the important and are a member of the carrot family (Umbelliferae) and are considered an annual herb and a spice, since both its leaves and seeds are used as a condiment. It is one of the first spices used by mankind and has been cultivated since antiquity. Coriander leaves have a feature in the culinary traditions of Latin American, Indian and Chinese cuisine. It is believed that the plant has been known in India since the Vedic Period but during that time it was mostly used as its fresh leaves. Apart from imparting a delicious taste, it has high nutritive value used in many culinary preparations and it serves several medicinal actions. Processing and preservation of coriander leaves by suitable methods is a major thrust area since long back. The various kinds of methods followed for drying of coriander leaves, such as solar drying, hot air convective drying, fluidized bed drying, microwave drying and infrared drying. These techniques are mainly used for preservation and value addition of Coriander leaves.

Introduction

Coriander (*Coriandrum sativum* L.) leaves are a member of the carrot family (Umbelliferae) and are considered an annual herb and a spice, since both its leaves and seeds are used as a condiment. It is one of the first spices used by mankind and has been cultivated since antiquity (Small, 1997). Coriander leaves have a feature in the culinary traditions of Latin American, Indian and Chinese cuisine. It is believed that the plant has been known in India since the Vedic Period but during that time it was mostly used as its fresh leaves. The plant produces a slender, hollow stem with leaves and small pink flowers. It is valued for the fruits, called 'coriander seeds' and the fresh green leaves called as 'cilantro' in the Americas. In India, this crop is commercially cultivated in Rajasthan, Madhya Pradesh, Gujarat, Tamil Nadu, Andhra Pradesh, Assam, etc. The coriander production is estimated to be around 313.65 MT from an area of 447.13 ha in which

Gujarat produces around 32.31 MT from an area of 20.57 ha. Rajasthan (54%) and Madhya Pradesh (17%) are the two largest coriander producing states in the country contributing over two-thirds to the country's total production. The other coriander producing states are Gujarat (6.9%), Assam (6.6%), Andhra Pradesh (3.5%), Karnataka (3.3%), Orissa (3.2%) and Tamil Nadu (2%) (NHB, 2014). The every part of coriander like root, stem, leaves and fruits has a pleasant aromatic odour and is widely used in flavouring. The two primary products that used for flavouring purposes are the fresh green herb and the spice; the odour and flavour of these two products are different. The herb is used for culinary flavouring purposes in Asia, the Middle East and Central and South America (USDA, 2015). The entire plant, when young, is used in preparing chutneys and the leaves are used for flavouring curries, sauces and soups. The fresh leaves may also be used as a garnish for curries and other dishes and are used as a green vegetable by some ethnic groups. It is an essential colouring and flavouring ingredient in a popular seasoning of North India called chat masala (Raghavan, 2007). In India, this crop is commercially cultivated in Rajasthan, Madhya Pradesh, Gujarat, Tamil Nadu, Andhra Pradesh, Assam, etc. The coriander production is estimated to be around 313.65 MT from an area of 447.13 ha in which Gujarat produces around 32.31 MT from an area of 20.57 ha. Rajasthan (54%) and Madhya Pradesh (17%) are the two largest coriander producing states in the country contributing over two-thirds to the country's total production. The other coriander producing states are Gujarat (6.9%), Assam (6.6%), Andhra Pradesh (3.5%), Karnataka (3.3%), Orissa (3.2%) and Tamil Nadu (2%) (NHB, 2014). The green leaves of coriander contain 87.9 % moisture, 3.3 % protein, 0.6 % fat, 6.5 % carbohydrates and 1.7 % mineral. Coriander leaves are a very good source of dietary fibre and a good source of iron, magnesium and manganese. Coriander leaves also constitute one of the richest sources of vitamin C as well as vitamin A. The dried leaf contains higher amounts of vitamin C, potassium, phosphorus, calcium, magnesium and iron (Peter, 2012). The market for dehydrated vegetables and leaves is important for most countries worldwide due to their medicinal and antioxidant properties. Particularly, in many Asian countries has stimulated increasing demand for high-quality dehydrated vegetable products (Bobic *et al.,* 2002). This trend is expected to continue and even accelerate over the next decade in all emerging economics of the world.

Dehydration offers a means of preserving food in a stable and safe condition. Drying has the advantage of facilitating the preservation of products, prolonging shelf life and reducing the volume of the product. This facilitates and reduces costs of transportation, promoting physico-chemical stability and adding economical value to the final product (Silva *et al.,* 2008). Drying is a complex unit operation involving simultaneous heat and mass transfer, particularly under transient condition. It is one of the earliest method of increasing the storage life of perishable agricultural produce by decreasing its moisture content thus the growth of undesirable microorganism by reducing the water activity and extend the shelf life (Barbosa and Mercado, 1996).

Drying characteristics of Coriander leaves

Pande *et al.,* (2000) studied the solar drying of coriander leaves in a forced circulation solar hot-air-dryer. Drying of coriander leaves were dried at 40, 45 and 50 °C. Drying characteristic curves were drawn and drying equations were developed to understand the drying behaviour of these leafy vegetables

and to undertake appropriate solar dryer design. Organoleptic quality attributes like colour, appearance and taste of these dried samples were found acceptable to the respondents and solar-dried samples were appreciated for retaining fragrance and utility in off-seasons.

Ahmed *et al.*, (2001) studied drying characteristics and quality attributes of coriander leaves with selected drying air temperatures of 45, 50, 55, 60 and 65 °C. Total drying time considerably reduced with the increase in drying air temperature. The product quality in terms of chlorophyll content and rehydration capacity were found to be maximum when the coriander leaves were dried at 45 °C.

Da-Yu and Kai-Bin (2004) studied on freeze drying of coriander (*Coriandrum sativum* L). The effects of plate temperature and coriander weight of freeze-drying on lyophilizing time, sample quality and productive forces were investigated. Lyophilizing time decreased 15.68 % as the plate temperature increased 10 °C; however, coriander got the flavour when the temperature was over high. Lyophilizing time increased 2.5-3 h as coriander weight increased 100 g per layer. Lyophilizing time was found required 12.5 h at a plate temperature of 40 °C with coriander weight of 400 g per layer. The quality of the lyopilized sample was superior to that of the vacuum dried sample, after redehydrating which was close to the fresh sample (Quenzer and Burns, 1981).

Tang *et al.*, (2007) studied the vacuum freeze-dry technology of coriander. Through the experiment, they have come to conclusions that floats burns of the coriander the temperature of the coriander is 90 °C; floats burns the time is 60 s, the best material area weight is about 1260 g/m2, the freezing dry temperature is 45 °C. At the same time, they have obtained its freezing dry curve and the best packaging. The vacuum packaging can be able to maintain coriander′s better quality.

Thirugnanasambandham and Sivakumar (2014) studied the enhancement of shelf life of *Coriandrum sativum* leaves using vacuum drying process applied to evaluate and optimize using three key drying parameters such as temperature, loading rate and vacuum. This approach provided statistically significant quadratic model which was adequate to predict response and to carry out optimization under the conditions studied. It was demonstrated that the interaction between all the drying parameters has a significant effect on the moisture removal. The optimal conditions were found to be temperature of 75 °C, loading rate of 0.63 kg/m2 and vacuum of 28 mm Hg. Under these conditions, 95% moisture removal, 527 mg/100 g Vitamin C content and 13 mg/100 g total dietary fibre were obtained. These results show that drying process using vacuum is an effective method to enhance moisture removal from coriander leaves.

Patil *et al.*, (2015) studied the dehydration of green leafy vegetables (fenugreek, coriander, spinach, mint, shepu and curry leaves) and its effect on quality. Microwave drying characteristics of GLVs were assessed at five different microwave output powers ranging from 135, 270, 405,540 and 675 Watts (W) were used for drying GLVs. Irrespective of GLVs, drying in microwave oven at 135 and 270 W power was significantly greater time of 25-30 minutes when compared to time of drying as 25, 20, 10 min, respectively, at 405, 540 and 675 W power, which were at par with each other. Both spinach and coriander leaves needed maximum time of 30 and 25 min, respectively to dry to crispness which was significantly higher than curry leaves and shepu leaves irrespective of microwave powers. Among the leafy vegetables, spinach

found significantly higher time of 30 min to dry at 135 W power followed by coriander (25 min). On the contrary, at 540 and 675 W power, coriander had taken lower time of 20 and 15 min, respectively for drying. The results indicated that as the microwave output power increased to 675 W from 135 W, the drying time decreased significantly by 64 %. Chlorophyll content was found to be higher in microwave oven dried shepu (58.23%) and coriander (82.81%) at 135 W microwave output power.

Quality evaluation of Coriander leaves

Rehydration Ratio

Ahmed *et al.,* (2001) studied drying characteristics and quality attributes of coriander leaves with drying air temperatures of 45, 50, 55, 60 and 65°C. Rehydration capacity decreased with the increase in the drying air temperature from 45 to 65°C and was maximum (0.308) at 45°C. The rehydration ratio was found to be maximum when the blanched leaves were dried at 45°C.

Ascorbic acid

Sangwan *et al.,* (2011) studied the bio-chemical analysis of coriander leaves powder prepared using various drying methods. Coriander (*Coriandrum sativum*) leaves was dried using four different drying methods i.e., shade, solar, oven and microwave. The shade drying was used at room temperature; oven drying was maintained at 50 ± 5°C temp. for 6-8 h. Microwave drying was done in microwave of 800 W powers for 3 to 4 minutes and solar drying was maintained in hot air solar dryer at 54° C temp. for 6-8 h.

Ascorbic acid content of shade, solar, oven and microwave dried coriander leaves powder obtained 66.87, 49.72, 50.43 and 65.57 mg/100g, respectively. Whereas, ascorbic acid contents were maximum in shade dried coriander leaves powders i.e. 66.87 mg/100g (Ranganna, 1986).

Iron

Sangwan *et al.,* (2011) studied the bio-chemical analysis of coriander leaves powder prepared using various drying methods. Coriander (*Coriandrum sativum*) leaf was dried using four different drying methods i.e., shade, solar, oven and microwave. The shade drying was used at room temperature; oven drying was maintained at 50 ± 5°C temp. for 6-8 h. Microwave drying was done in microwave of 800 W powers for 3 to 4 minutes and solar drying was maintained in hot air solar dryer at 54° C temp. for 6-8 h. Total Iron content of shade, solar, oven and microwave dried coriander leaves powder varied 20.54, 19.98, 20.48 and 20.50 mg/100g, respectively. Whereas, Iron contents were maximum in shade dried coriander leaves powders i.e. 20.54 mg/100g.

Magnesium

Khanum *et al.,* (2013) studied the impact of drying coriander herb on antioxidant activity and mineral content. Coriander herb was dried using four different drying methods viz., Low temperature Low humidity (LTLH) drying, Infrared (IR) drying, Sun drying and hot air oven drying (60, 80 and 100°C) and analyzed. The effect of drying on magnesium content was estimated. LTLH dried coriander showed higher Magnesium content Mg (461.3 mg/g) followed by IR, hot air (60°C) and sun drying (Porntewabancha *et al.,* 2010).

Water activity

Kathirvel *et al.,* (2006) studied the microwave drying - a promising alternative for the herb processing industry. Fresh and dried herbs are widely used as flavouring agents in many

different food products on account of their powerful aromatic odour. The introduction of a microwave drying technique could offer a promising alternative for the herb processing industry. Hence, the efficacy of microwave drying of herbs viz., mint, coriander, dill and parsley leaves with respect to water activity at selected levels of microwave power density (10, 30, 50, 70 and 90 Wg-1) was investigated and compared with convection air drying (45, 60 and 75°C). The water activity values of dried coriander leaves are given 0.380, 0.333, 0.319, 0.293 and 0.286 for microwave power density 10, 30, 50, 70 and 90 Wg-1 whereas the corresponding values of hot air dried leaves from 0.278, 0.304 and 0.330 for 45, 60 and 75 °C.

Storage study of Coriander leaves

Patil *et al.,* (2015) studied the dehydration of green leafy vegetables (fenugreek, coriander, spinach, mint, shepu and curry leaves) and its effect on quality during storage. Storage studies on the final products prepared by optimizing process conditions were conducted at different relative humidities, temperatures and packaging materials. Two types of packaging materials viz., polypropylene polyethylene (PP) and metalized polyester (MP) were used for storage studies, as these materials are known to be fairly good moisture and oxygen resistant and are being used commercially for packaging of dehydrated leafy vegetables. Microwave oven dried GLVs could be stored for about 3 weeks in packaging material of metalized polyester (MP), under extreme condition (45°C, 95% RH). However, the shelf life of these GLVs dried in microwave oven could be predicted to be minimum six months if stored in metalized polyester (MP) at 65% RH and 30 °C temperature.

Review of different dehydration techniques of coriander leaves reveal that several analytical and numerical methods are available for analyzing the drying behavior as well as quality parameters. However, there are some other methods of drying such as vacuum drying, freeze drying, hot air drying etc. which can be explored in order to assess the effect of different operating parameters on quality of coriander leaves as it contains several essential nutrients and has huge medicinal value. Combination of two or more drying methods or multimode drying techniques can also be adopted for drying of coriander leaves. Moreover, there is a scope for establishing proper correlation between drying conditions and energy consumption of dehydrated coriander leaves. Further research can be done to recommend suitable method of drying and to optimize the requisite conditions for drying of coriander leaves.

References

Ahmed, J.; Shivhare, U. S. and Singh, G. (2001). Drying characteristics and product quality of coriander leaves. *Trans Icheme,* Vol. 79 : 103-106.

Anonymous, (2014). National Horticultural Board 2014.

Anonymous, (2015). USDA National Nutrient Database 2015.

Barbosa-Canovas, G. V. and Vega-Mercado, H. (1996). Dehydration of foods. *Journal of Food Engineering*, 49: 271-289.

Bobic, Z.; Baumani, I. and Curic, D. (2002). Rehydration ratio of fluid bed dried vegetables. *Sadhana*, 27 : 365–374.

Da-yu, L. and Kai-bin, L. (2004). Studies on freeze drying of coriander (*Coriandrum sativum* L.). *Food Science*, 25(1): 182 – 185.

Kathirvel K, Naik KR, Gariepy Y, Orsat V, Raghavan GSV (2006). Microwave drying-a promising alternative for the herb processing industry. In 2006 ASAE Annual Meeting (p. 1).

Khanum H., G. Sulochanamma, B. B. Borse. 2013. Impact of drying coriander herb on antioxidant activity and mineral content. J Biol Sci Opin; 1(2): 50-55.

Pande, V. K.; Sonune, A. V. and Philip, S. K. (2000). Solar drying of coriander and methi leaves. *Journal of Food Science and Technology*, 37(6) : 592-595.

Patil, G. D.; Pardeshi, I. L. and Shindec, K. J. (2015). Drying of green leafy vegetables using microwave oven dryer. *Journal of Ready to Eat Food*, 2(1) : 18-26.

Peter, K. V. (2012). Handbook of Herbs and Spices.Vol. 2: 216-244.

Porntewabancha, D. and Siriwongwilaichat, P. (2010). Effect of pre-treatments on drying characteristics and colour of dried lettuce leaves. *Asian Journal of Food and Agro-Industry*, 3(06): 580-586.

Quenzer, N. M. and Burns, E. E. (1981). Effect of microwave, stem and water blanching on freeze dried spinach. *Journal of Food Science.*46 : 410-413.

Raghavan, S. (2007). Handbook of Spices, Seasonings and Flavourings, pp : 98-101.

Ranganna, S. (1986). Handbook of Analysis and Quality Control for Fruit and vegetable Products. Tata McCraw-Hill Publishing Ltd., New Delhi.

Sangwan, A.; Kawatra, A. and Sehgal, S. (2011). Bio-chemical analysis of coriander leaves powder prepared using various drying methods. *Journal of Dairying, Foods & Home Sciences*, 30 (3): 202 – 205.

Silva, A. S.; Almeida, F. A. C.; Gomes, J. P..; Lima, E. E. and Silva, F. L. H. (2008). Drying kinetics of coriander (*Coriandrum sativum L.*) leaf and stem. *CienciayTecnologíaAlimentaria*, 6(1) : 13-19.

Small, E. (1997). *Culinary herbs*, NRC Research Press, Ottawa, pp :219 –225.

Tang X.; Zhang, Z.; Jiang, Y. and Zhang, Q. (2007). Research on vacuum freeze-dry technology of coriander. *Food Science and Technology*, 5 : 85-88.

Thirugnanasambandham, K. and Sivakumar, V. (2014). Enhancement of shelf life of *Coriandrum sativum* leaves using vacuum drying process: Modeling and optimization. *Journal of the Saudi Society of Agricultural Sciences*, 13(2): 1-7.

USDA (US Department of Agriculture) (2015) Scientific Report of the 2015 Dietary Guidelines Advisory Committee. US Department of Agriculture. Washington DC, 7.

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