J. Dairying, Foods & H.S., **27** (3/4) : 238 - 240, 2008

STUDY OF DEHYDRATION CHARACTERISTICS OF GARLIC

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ABSTRACT

The present study was carried out to evaluate the dehydration characteristics of garlic treated by using different methods. The effect of pretreatments *viz.* control (without any treatment), sample blanched in hot water at a temperature of 80-85°C for a duration of 5 min. and sample treated with 0.5% sodium metabisulphite for a duration of 20 minutes and dehydration methods *viz.* open sun drying, solar cabinet drying, electric tray drying, microwave oven drying was studied. The results of the study showed that the product quality of blanched sample for 55°C and sodium metabi-sulphite treated sample for 65°C in electric tray dryer was best, as compared to rest of the samples.

INTRODUCTION

Garlic (*Allium sativum* Linn.) is a bulbuos perential plant of the lily family (Liliaceae). Garlic bulbs are used either sliced or ground to flavour curries, soups, tomato sauces, stews, and salad dressings in south European and Asian cuisines. China is the highest producer of garlic followed by India, South Korea, USA, Egypt and Spain. The world prdouction of garli in 2002 was 12.23 MT, out of which 500,000 T was contributed by India (EBI, 2002). The garlic bulb develops underground and is composed of several small segments of cloves surrounded by a thin white or pinkish tough papery skin. The bulbs can be stored for a fairly long time and can withstand the hazards of rough handling and distant transport. Garlic is a good source of carbohydrates protein and phosphorus. Dehydrated garlic, like onion has been in great demand. Garlic is dried mainly to produce slice, cubes, chunks and powder. Powdered garlic attempts to mirror the chemcial profile of fresh garlic in a stabilized form. A little work is done in relation to determination of dehydration characteristics and the changes occuring in garlic during dehydration. Das and Bhatnagar (1991) reported that slice thickness affected the drying behaviour of garlic and found that a small amount of sulphite in blanched garlic makes it possible to increase the drying temperature, thus shortening the drying time and correspondingly increasing the dryer capacity without exceeding the tolerance of heat damage. Pezzutti and Crapiste (1997) studied on the drying kinetics of garlic slices and the effect of process variables on drying kinetics. Brar *et al.* (1994) studied the physico-chemical characteristics of selected varieties of garlic grown in India. Ahmed *et al.* (1993) reported that the peeled cloves were dehydrated in a tray drier at 55-60^{0}C. The drying was carried out to a moisture level of 7.8% starting with an initial moisture content of 69% in fresh garlic cloves. Hong *et al.* (1999) studied the effects of processing treatments on the composition and change of flavour compounds in garlic extracts. Sharma and Prasad (2001) reported that combined microwave - hot air drying resulted in reduction in the drying time to an extent of 80-90% in comparison to conventional hot air drying and superior quality product. Kim *et al.* (1992) reported that soaking of garlic slices in 0.5% sodium metabisulphate solution for 20 min prior to drying reduce pyruvate loss during heating, and inhibited browning and reduced microbial counts, which proved better storage for garlic.

MATERIAL AND METHODS

Garlic (*Allium sativum* Linn.) variety HG-17 was procured from the University Farm

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to ensure the uniformity of the samples. The cloves were separated from the bulb and three samples *viz.* control (without any treatment), sample blanched in hot water at a temperature of 80-85^{0}C for a duration of 5 minutes and sample treated with 0.5% sodium metabisulphite for a duration of 20 minutes of 100 gm each having initial moistue content of 66.67% (wb) were taken for the study. The effect of dryring methods *viz.* open sun drying, solar cabinet drying, electric tray drying (45^{0}C, 55^{0}C and 65^{0}C), microwave oven drying was studied on the dehydration characteristics of garlic. Two parameters such as moisture content (by weight reduction method) and optical density/ browning index (calculated at 440 nm by calorimeter by treating 5gm in 50 ml alcohol) were used to evaluate the effect of dehydration methods and the pretreatments. Finally, a Hedonic Scale was used to evaluate the organoleptic properties of dehydrated cloves of garlic.

RESULTS AND DISCUSSION

The results of the experiments carried out and the effects of different pre-treatments and drying methods on dehydration characterstics of garlic is presented in Table 1. The product quality was evaluated by its colour in terms of browning index and organoleptic score.

The results showed that the sun drying resulted in poor quality for all samples with low organoleptic score due to long exposure to sun. Similar results were obtained for the solar cabinet dryer, although the drying time reduced from 20 hrs to 14 hrs to achieve a final moisture content 3-5% (db) with a better product quality as compared to open sun drying.

Table 1. Effects of different drying methods and pre-treatments on dehydration characteristics of garlic.

Drying method	Temperature range (°C)	Duration (hours)	Pre-treatments	Initial M.C. (%db)	Final M.C. (%db)	Browning index O.D.	Sensory score on Hedonic scale of 10
Open sun drying	27-40°C	20 hours	P_1	200	3.43	0.107	5.0
			P_2	214	4.15	0.092	5.5
			P_3	216	4.17	0.102	5.5
Solar cabinet drying	35-67°C	14 hours	P_1	200	3.13	0.087	5.5
			P_2	214	3.30	0.062	6.5
			P_3	216	3.47	0.069	6.0
Electric tray drying	45°C	13 hours	P_1	200	3.96	0.054	6.0
			P_2	214	4.65	0.042	7.0
			P_3	216	4.86	0.046	6.5
	55°C	11 hours	P_1	200	3.60	0.045	6.0
			P_2	214	4.49	0.031	8.0
			P_3	216	4.64	0.042	7.0
	65°C	8 hours	P_1	200	3.41	0.056	5.5
			P_2	214	3.61	0.054	6.5
			P_3	216	3.82	0.032	8.0
Microwave oven drying	–	20 minutes	P_1	200	3.56	0.036	6.5
			P_2	214	4.11	0.033	7.5
			P_3	216	4.21	0.034	7.0

P_1 = Controlled (Without any treatment) sample

P_2 = Blanched sample (in hot water at a temperature of 80-85^{0}C for a duration of 5 min.)

P_3 = Sodium metabisulphite treated sample (treated with 0.5% sodium metabisulphite for a duration of 20 min.)

It was also observed that the drying time in electric tray dryer with dryer temperature of 45°C , 55°C and 65°C was 13 hours, 11 hours and 8 hours respectively to achieve a final moisture content of 3-5% (db). At 55°C, quality of the hot water blanched sample was best with average organoleptic score of 8.0 and browning index of 0.031 whereas, at higher temperature (65°C) the quality of the sample treated with 0.5% sodium metabisulphite was the best with average organoleptic score of 8.0 and browning index of 0.032. This may be because of the fact that samples treated with 0.5% sodium metabisulphite for a duration of 20 minutes can withstand higher temperatures as compared to hot water blanching at a temperature of 80-85°C as reported by Kim *et al*. (1992).

Micowave oven encountered fast rate of drying and there is no significant effect of preteatments on the quality of dried product. It took just 20 minutes to dry the sample to desired moisture content of 3-5% (db) with better product quality.

The selection of the best drying method and pretreatment was based on the browning index and organoleptic score. It is concluded that dehydration of garlic in electric tray dryer for hot water blanched sample at 55°C and the sample treated with 0.5% sodium metabisulphite at 65°C were found optimum for obtaining desirable quality of the product.

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