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Influence of Pretreatment on Dehydration Pattern of Organic and Inorganically Grown Broccoli *Brassica Oleracea* in Solar and Tray Dryer

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Abstract—*In this work, broccoli (Brassica oleracea) dehydration pattern were obtained using One lot was subjected to no treatment (Control), second lot was subjected to sulphuring by dipping in 2 per cent solution of potassium metabisulphite for 5 minutes, third lot was subjected to water blanching for 1-2 minutes. The treated samples were dried in the mechanical tray drier (at 60ºC) and kept in solar drier until constant weight was achieved. Results of study revealed that the drying time was less in case of organic broccoli as compared with inorganic broccoli. This was attributed to higher moisture content in inorganic broccoli. The drying times were also less in case of tray dryer compared to solar dryer. This was due constant heat supply in tray dryer. For both dryer using pretreatments potassium metabisulphite (KMS) the time of drying was less as compared with control and water blanched pretreatments. The results indicated that broccoli dried with pretreatment potassium metabisulphite (KMS) under tray dryer have better moisture depletion pattern as compared to other pretreatment. From the findings of the study concluded that dehydration pattern of broccoli study can help to minimize their post harvest losses as these vegetables are highly perishable due to high moisture content.*

Keywords*: Blanched, Broccoli, Drying, Kale, KMS*

1. INTRODUCTION

The drying technique is probably the oldest and the most important method of food preservation practiced by humans. It can be either be an alternative to canning and freezing or compliment these methods. Drying food is simple, safe and easy to learn.

A very common method of preservation for these agricultural crops is to dry them in order to conserve the perishable fruits, reduce storage volume and to extend their shelf life beyond the few weeks when they are in season [5]. Drying can either be done by traditional sun drying or industrially through the use of solar dryers or hot air drying [9]. During drying fruits and vegetables may be blanched as pre-treatment to lessen changes in colour and reduce the total number of microorganisms in the food [10].

Dried foods are ideal for backpacking and camping. They are lightweights take up little space and do not require refrigeration. During drying many changes take place; structural and physic- chemical modifications affect the final product quality, and the quality aspects involved in dry conversion in relation to the quality of fresh products and applied drying techniques. Currently hot air drying is most widely used method in post harvest technology of agricultural products. Using this method, a more uniform, hygienic and attractively colored dried product can be produced rapidly. The solar dryer could be alternative to the hot air and open sun drying methods, especially in locations with good sunshine during the harvest season [8].

Broccoli (*Brassica oleracea*) is very low in calories. It is rich in dietary fibers, minerals, vitamins and anti-oxidants that have proven health benefits. The nutritional quality of organically grown broccoli has higher levels of macronutrients, vitamins and minerals when compared with conventionally grown broccoli. The aim of study was to study and compare the moisture depletion pattern (drying curves) for drying of broccoli (*Brassica oleracea*) using solar and tray dryer methods with three pre-treatments like control, potassium metabisulphite (KMS) and water blanching.

2. MATERIAL AND METHODS

2.1 Raw material

Fresh and optimally mature organically grown samples of broccoli (var *Palam Samridhi*) was procured from the Department of Organic Agriculture, CSKHPKV, Palampur whereas, same varieties of broccoli was grown conventionally using inorganic inputs. The procured samples were brought to the Postgraduate laboratory of Department of Food Science, Nutrition and Technology, College of Home Science, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur.

2.2 Preparation of products

The broccoli flowers were washed in running water. For dehydration, broccoli sample grown organically and conventionally was taken and divided into three lots. One lot was subjected to no treatment (Control). The second lot was subjected to sulphuring by dipping in 2 per cent solution of potassium metabisulphite for 5 minutes. The third lot was subjected to water blanching for 1-2 minutes.

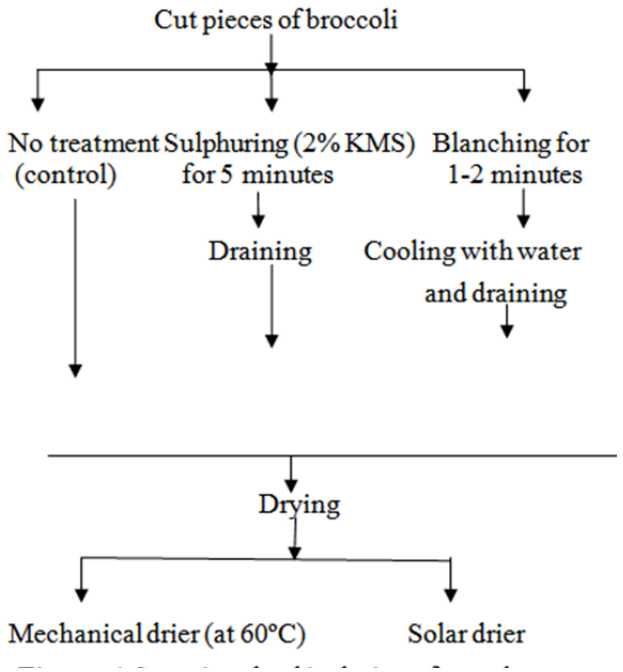

Fig. 1 Steps involved in drying of samples

2.3 Drying

The treated samples were dried in the mechanical tray drier (at 60ºC) and the loss in weight was measured at an interval of 5 min for the first half hour, 10 min interval for next half hour, 15 min interval for next one hour and 30 min for the drying period until constant weight was achieved.

In case of solar dryer the moisture depletion pattern at an interval of half hour for the drying period until constant weight was achieved. The drawn samples were analyzed for moisture content.

Drying curves were drawn by plotting moisture content (%) against time of drying (h) to study the moisture depletion pattern.

3. RESULTS AND DISCUSSION

3.1 Drying curve assessment

The drying curve enables to predict the moment at which the process should be stopped, when the required moisture content has been reached and thus obtaining a good quality product.

The moisture depletion patterns of broccoli organic and inorganic with different treatments such as control (untreated), KMS (sulphuring), blanched at different drying sources i.e. tray drier and solar drier are illustrated in figure (2, 3, 4, 5).

The figure (2, 3, 4, 5) showed that the drying curves followed a declining trend with different treatments such as control (untreated), KMS (sulphuring), blanched at different drying sources i.e. tray drier and solar drier. The drying rate was higher during initial stage of drying. Afterwards, it showed down steadily.

Figure 2 depicted that organic broccoli in tray drier lost moisture content of 77, 75 and 79 after 1 hour of drying of control, KMS and blanched treatments, respectively. Treatments control, KMS and blanched, respectively took 10.30, 10 and 11.30 hours for drying to reach a constant weight

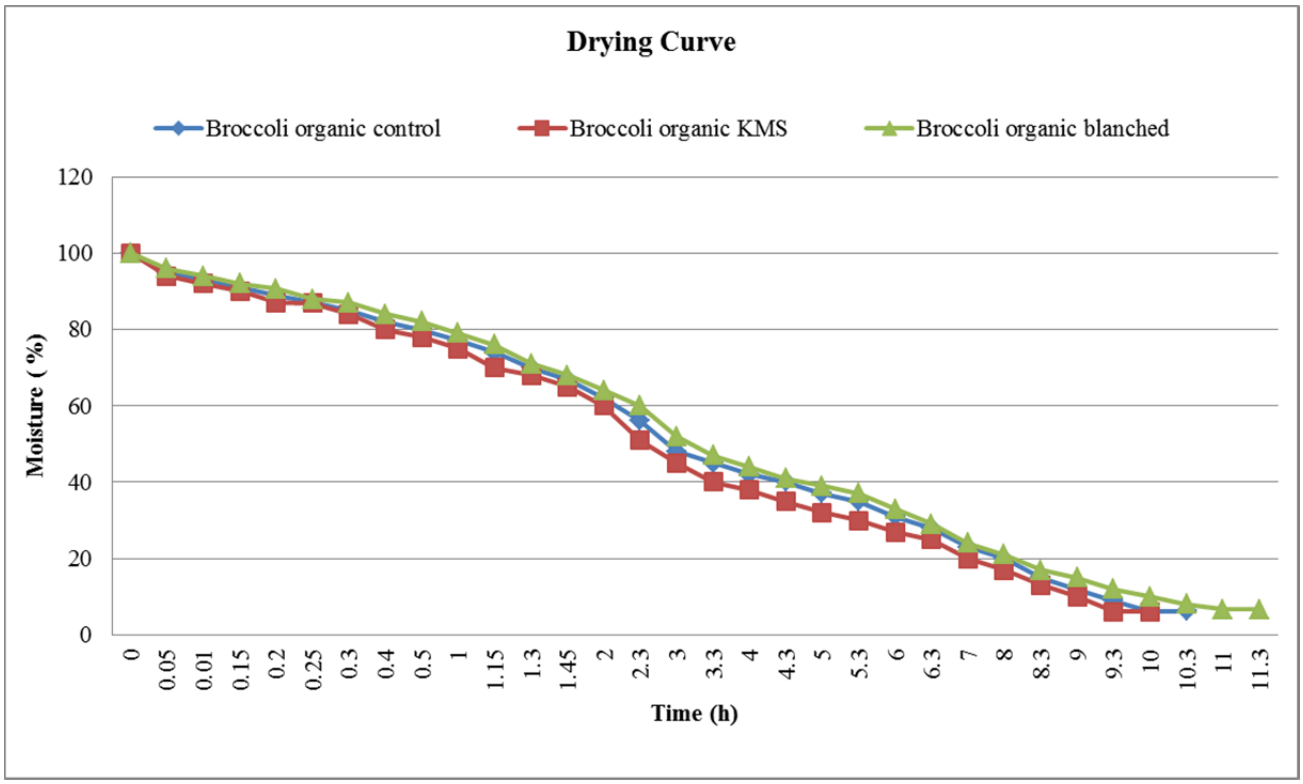

Fig. 2 Dehydration pattern of organic broccoli in tray drier

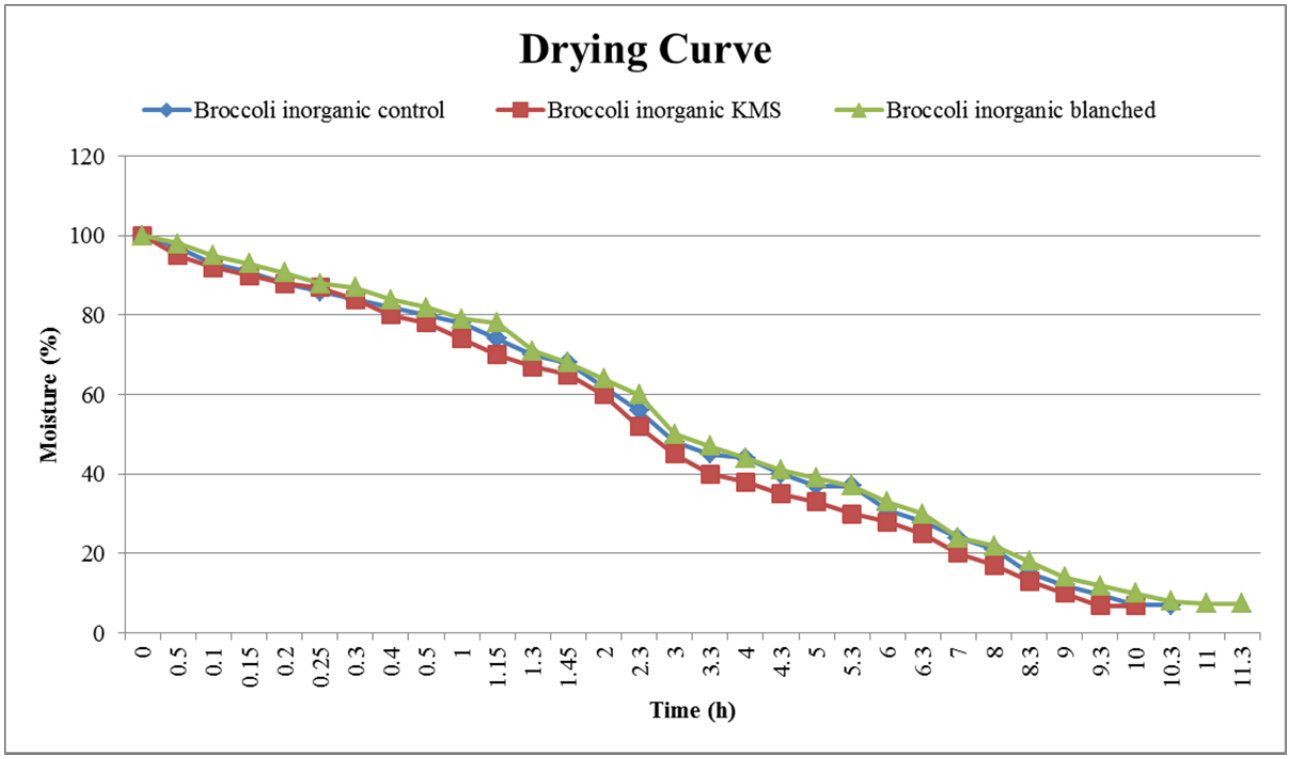

Fig. 3 Dehydration pattern of inorganic broccoli in tray driercorresponding to 6.27, 6.13 and 6.74 percent moisture content.

The drying curves in figure 3 illustrated the depletion patterns in their moisture content of inorganic broccoli in tray drier with various treatments. The moisture reduction of 78, 74 and 79percent was recorded within 1hour drying of control, KMS and blanched respectively. Treatments control, KMS and blanched, respectively took 10.3, 10 and 11.3 hours for drying to reach a constant weight corresponding to 7.07 6.85 and 7.38 percent moisture content.

The moisture depletion pattern of dried organic broccoli in consequence with various treatments and solar drier is presented in figure-4. The moisture reduction of 92, 94 and 95.4percent was recorded within 1hour drying of control, KMS and blanched, respectively. The time taken for complete drying was 13.15, 13.45 and 13.55 hour for control, KMS and blanched respectively. The moisture content of dried organic broccoli control, KMS and blanched were 7.35, 7.12 and 7.46 respectively.

Figure 1d depicted that inorganic broccoli in solar dryer lost moisture content of 93, 95and 96 percent after 1hour of drying of control, KMS and blanched treatments, respectively. Control, KMS and blanched treatments respectively took 13.20, 13.50 and 14.00 hours for drying to reach a constant weight corresponding to 7.14, 7.06 and 7.37 percent moisture content.

Further scrutiny of curves showed that among the various treatments such as control, KMS and blanched maximum moisture was observed in blanched organic broccoli samples followed by control and KMS treated organic and inorganic broccoli.

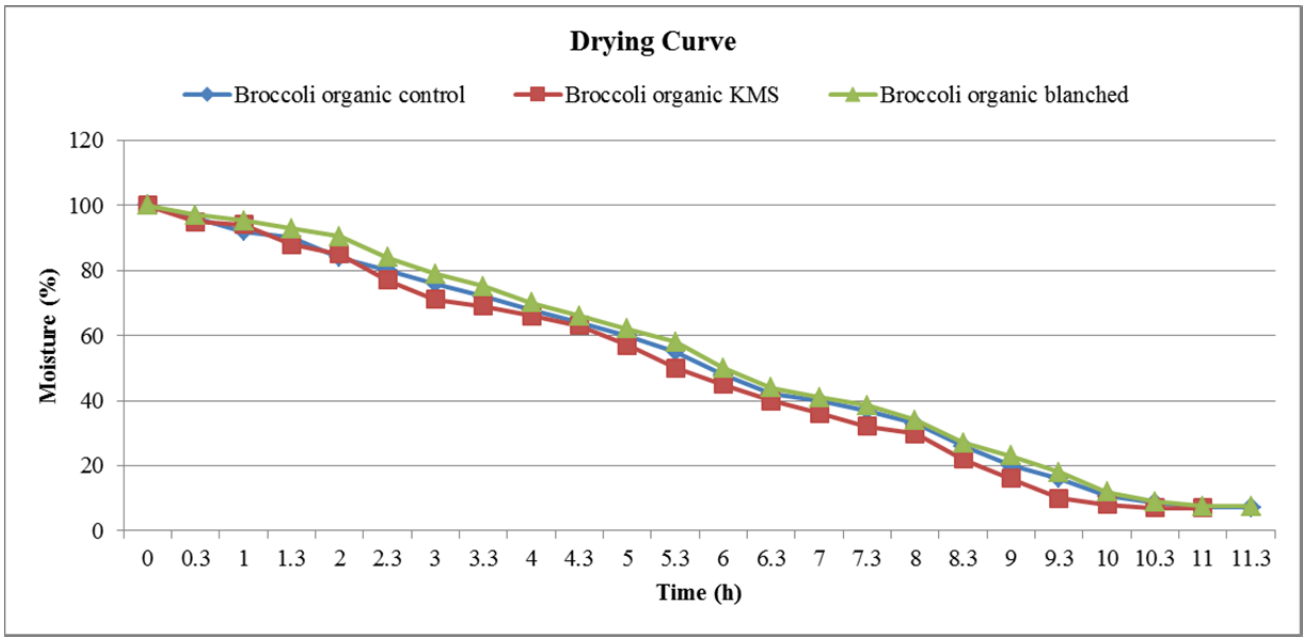

Fig. 4 Dehydration pattern of organic broccoli in solar drier

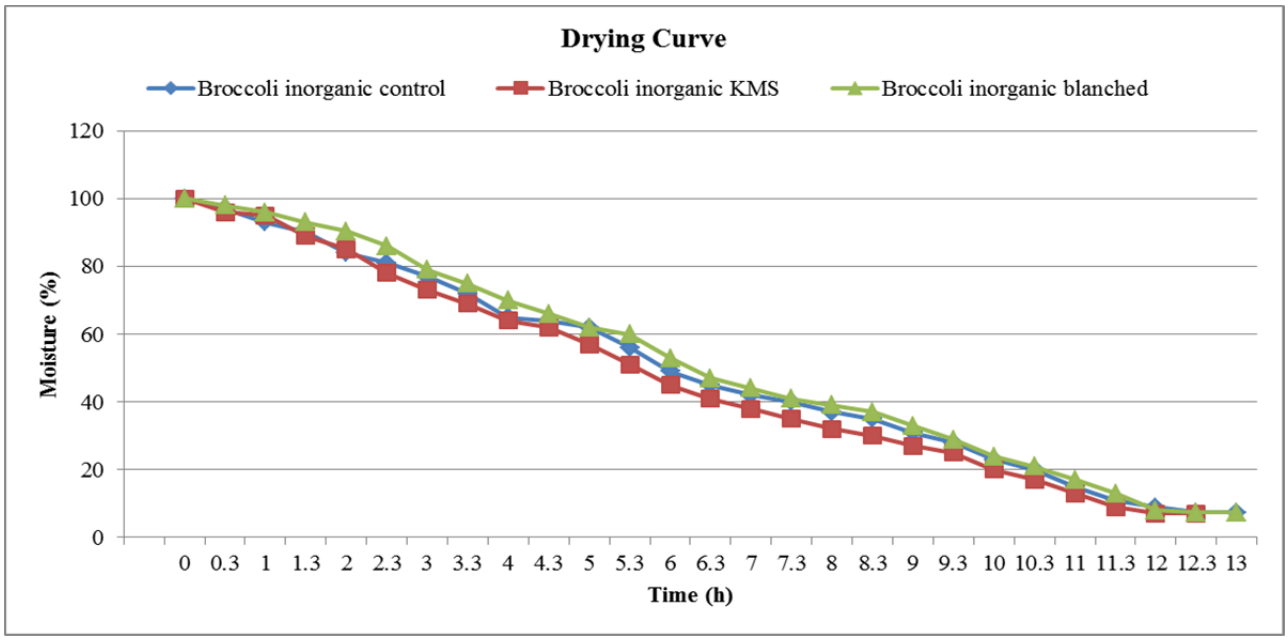

Fig. 5 Dehydration pattern of inorganic broccoli solar drier

Control, KMS and blanched samples tend to exhibit the same falling tread of drying. But, the rate of drying was faster in KMS treated samples followed by control and blanched. The drying rate was faster in tray drying followed by solar drying. The better result of tray drier was due to high temperature low relative humidity and fast removal of water in addition to constant air flow. If we compared the organic and inorganic broccoli irrespective of treatments and drying source organic broccoli took less time to attain equilibrium weight when compared with inorganic broccoli. Similar results have been reported by [2, 3, 11, 1, 4, 7 and 6].

4. CONCLUSION

The drying of broccoli revealed that the samples treated with KMS and dried in mechanical drier took minimum time for drying and were low in moisture content. Blanched samples took more drying time and were high in moisture content when compared with sulphur treated samples. Blanching of vegetables resulted in an increase in drying time as these had more water in them as compared to sulphur treated and control samples.Mechanically dried vegetables took less time for drying and had lower moisture content as compared to solar dried samples. Sulphur treated broccoli samples dried in tray drier had better rehydration property when compared with other treatments.

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