

# Effect Of Drying On Curry Leaves Using Different Drying Methods

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**Abstract**—The curry leaves (*Murraya koenigi*) one in every of inexperienced green was wide employed in Asian nation for seasoning purpose. The ivy-covered vegetables area unit extremely putrescible in nature and so terribly short period. These curry leaves were washed and pre-treated with 0.1, 0.2, 0.3, 0.4, 0.5 per cent of bicarbonate of soda in cold water five for five minutes. The treated curry leaves were then dried in several drying condition like direct Sun drying (30-40°C) for 4-6 days, receptacle drying (40-60°C) for 3-5 hours, and kitchen appliance drying (160-900 W) for 12-26 min. The dried leaves were analyzed for his or her proximate analysis.

**Keywords**— Curry leaves, Dehydration, Sodium bicarbonate

## I. INTRODUCTION

### A. Curry leaves

The curry leaves is a sub-tropical tree in the family Rutaceae which is native in India and Sri Lanka. The curry leaves are used in many dishes in India and Sri Lanka and other countries. Often used in curries, the leaves are generally called by the name "curry leaves". The curry leaves are highly valued seasoning southern and west-coast of India, Sri Lanka and other countries. Usually fried curry leaves with onion in the first stage of preparation. The curry leaves are also used Asian herb in Ayurveda medicine. They are believed in anti-diabetic properties. (Saini et al., 2013).

### B. Drying

Drying is a mass transfer process consisting of the removal of water or another solvent by evaporation from a solid, semi-solid or liquid. This process is often used as a final production step before selling or packaging products. To be considered "dried", the final product must be solid, in the form of a continuous sheet, long pieces, particles or powder. The drying rate during this period is mostly dependent on the rate of heat transfer to the material being dried. (Sakhale et al., 2001).

## II. MATERIALS AND METHODS

The experimental studies were carried out in department of agricultural engineering, Maharashtra institute of technology Aurangabad.

### A. Raw Materials

Curry leaves, sodium bicarbonate and potassium metabisulphite were purchase from local market of Aurangabad.

### B. Preparation of Curry Leaves Powder

The curry leaves were washed by using water and pretreated with potassium metabisulphite and sodium bicarbonate in cold water for five minutes. (Table 1).

TABLE I. PROCESS VARIABLES AND THEIR LEVELS OF EXPERIMENTAL DESIGN

Drying method	Temperature				
	40°C	45°C	50°C	55°C	60°C
Tray drying	40°C	45°C	50°C	55°C	60°C
Microwave oven	180 W	360 W	540 W	720 W	900 W
Sun drying	30-40°C				

Potassium Metabisulphite (%)	Sodium Bicarbonate (%)
0.1	0.1
0.2	0.2
0.3	0.3
0.4	0.4
0.5	0.5

### C. Tray drying

Two hundred gram (200 gm) of raw curry leaves were spread on the tray and placed in to conventional drying at (40, 45, 50, 55 and 60°C) for 2-5 hr.

### D. Microwave drying

Two hundred gram (200 gm) of raw curry leaves were placed in to a glass fiber sheet in a microwavable plate and

then dried in microwave oven at different watt i.e. (180, 360, 540, 720 and 900 W) for 10-30 min.

*E. Sun drying*

Two hundred gram (200 gm) of raw curry leaves were folded into a thin sheet of paper and placed on a flat plate in direct sunlight (UV) rays at 30-40°C for 6 days at an average temperature of 37°C. The folded sheet was turned occasionally to allow even contact of the sun rays. The paper wrap was employed to reduce the possible effect of the environs on the leaves.

*F. Chemical Analysis*

The physico-chemical analysis of curry leaves powder included the estimation of moisture content (A.O.A.C. 2013), ascorbic acid (A.O.A.C. 2013), vit A (A.O.A.C. 2013) and Chlorophyll content.

III. RESULT AND DISCUSSION

Figure 1 illustrates the rate of removal of the moisture at different temperatures i.e. 40, 45, 50, 55 and 60oC. Drying curves indicated that the rate of moisture removal at 40oC was low. It took 255, 210, 195, 165 and 150 min for reducing moisture content to desired level at 40, 45, 50, 55 and 60oC respectively.

It was further observed that drying of curry leaves pretreated with sodium bicarbonate took place in decreasing rate. The drying rate was faster at the beginning, it decreases continuously with the removal of moisture and subsequently became more prominent with the increase in temperature. Initially the drying rates were significantly different at different temperatures (high at elevated temperature), and thereafter merged together before reaching to the final moisture content. The rate of removal of moisture at different intensities i.e. 180, 360, 540, 720 and 900W. The drying curves therein indicated that there was slow rate of moisture removal at 180W. It took 26, 22, 18, 14 and 12 min for reducing moisture content to a desired level of dried curry leaves which was pretreated with sodium bicarbonate at 180, 360, 540, 720 and 900W intensities respectively.

Initially the drying rates were significantly different at different temperatures (high at elevated temperature) and later on the merged together before reaching to the final moisture content. The data illustrates the rate of removal of moisture during sun drying (30 – 40oC). The drying curves indicated that there was slow rate of moisture removal during sun drying. It took 6 days for reducing the moisture content to a desired level, in the samples which were pretreated with sodium bicarbonate.

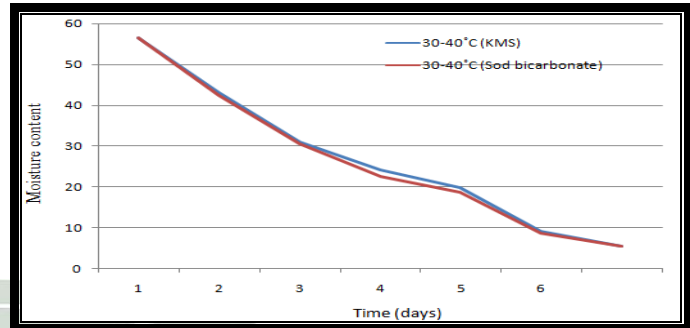
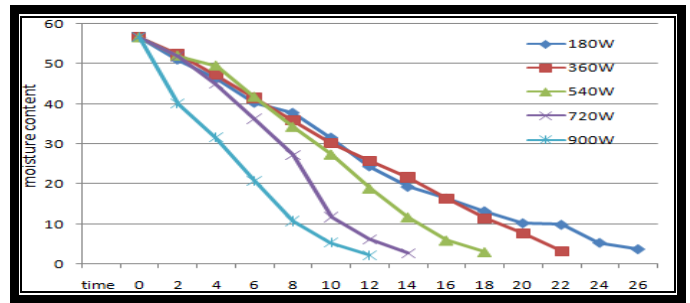
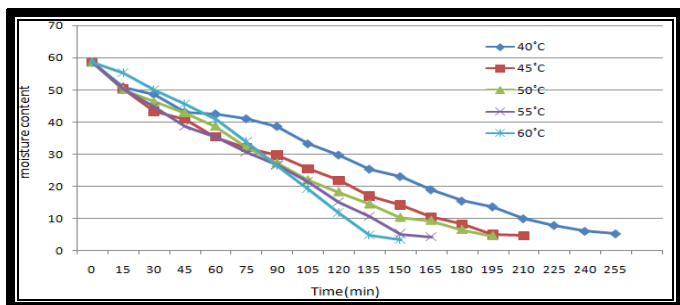


Fig. 1. Rate of drying of curry leaves at different temperatures.

The data presented in Table 2 revealed that curry leaves powder dried at different temperature show difference in chemical composition. The moisture content of curry leaves powder was 4.50-4.59 % in all pretreatments and temperatures. Similar trend was observed for vitamin A. The ascorbic acid content was high when the samples were dried at 40°C. The powder dried at 40°C showed more chlorophyll content from the result it was concluded that the powder dried at 40°C with 0.1 % sodium bicarbonate was better in with respect to the chemical attributes. At low temperature, the chemical properties were either similar or high. As the temperature of curry leaves powder increased the value of chemical properties got decreased. It is revealed that curry leaves powder dried at different temperature show difference in chemical composition. The moisture content of curry leaves powder was almost similar (3.62-6.68 %) in all pretreatments with Sodium Bicarbonate and intensities. Similar trend was observed for vitamin A. At the concentration of sodium bicarbonate of 0.3% the vitamin A content was 30.3 % at 360 W. The ascorbic acid content was high at 360 W in the treatment with 0.3% sodium bicarbonate (260.1µg/g). The powder dried under the influence of same treatment had more chlorophyll content (1.40 %) than that in powder dried under the influence of other treatments of curry leaves powder. From the result it was observed that the powder dried at 360 W under the influence of 0.3 % sodium bicarbonate was with better chemical attributes. At low temperature the chemical properties were either similar or higher than those observed at higher temperature. As the drying temperature of curry leaves powder increased the values of chemical properties got decrease.

The data presented in Table 4 The moisture content of curry leaves powder was identical (3.5-3.68%) in all treatments of sun drying similar trend was observed with respect to the fat content. Vitamin A content was high ( 33.7 percent )in the samples treated with 0.2% of sodium bicarbonate, while it was lowest when treated with either 0.1 or 0.4% sodium bicarbonate (33.1 and 33.0 percent respectively). The powder dried in sun using 0.2% of sodium bicarbonate had more ash

TABLE II. CHEMICAL ANALYSIS OF CURRY LEAVES POWDER USING TRAY DRYING AND MICROWAVE DRYING USING SODIUM BICARBONATE

Treatment (Sod. Bicarbonate)	Temp (°C)	Moisture (%)	Vit A (%)	As acid (mg/g)	Ch. content (%)	Power (Watt)	Moisture (%)	Vit A (%)	As acid (mg/g)	Ch. content (%)
0.1	40	4.5±0.2	29.3±0.2	292.8±0.1	1.47±0.2	180	3.6±0.3	28.3±0.2	259.3±0.3	1.38±0.3
0.2		4.5±0.1	28.6±0.2	289.7±0.1	1.44±0.2		3.6±0.1	28.2±0.3	258.4±0.2	1.37±0.2
0.3		4.5±0.2	28.0±0.2	290.3±0.2	1.46±0.3		3.6±0.2	27.4±0.2	257.6±0.2	1.37±0.2
0.4		4.5±0.2	28.0±0.1	291.8±0.3	1.43±0.1		3.6±0.1	28.3±0.3	257.4±0.3	1.35±0.1
0.5		4.5±0.1	29.2±0.3	290.5±0.3	1.45±0.1		3.6±0.1	29.1±0.1	258.4±0.2	1.36±0.3
0.1	45	4.5±0.3	26.7±0.2	286.9±0.3	1.45±0.1	360	3.6±0.1	29.7±0.2	259.9±0.1	1.39±0.3
0.2		4.5±0.1	26.5±0.1	287.5±0.2	1.43±0.1		3.6±0.3	29.2±0.2	259.6±0.3	1.38±0.1
0.3		4.5±0.2	26.7±0.2	288.3±0.2	1.44±0.2		3.6±0.1	30.3±0.1	260.1±0.2	1.40±0.3
0.4		4.5±0.2	26.9±0.3	284.5±0.2	1.43±0.2		3.6±0.3	29.2±0.2	259.8±0.3	1.37±0.1
0.5		4.5±0.3	27.2±0.2	283.4±0.3	1.42±0.3		3.6±0.2	29.9±0.1	259.7±0.1	1.39±0.2
0.1	50	4.5±0.3	26.9±0.2	286.8±0.3	1.42±0.2	540	3.6±0.3	28.9±0.1	258.6±0.3	1.37±0.1
0.2		4.5±0.2	26.8±0.3	288.2±0.2	1.43±0.3		3.6±0.2	29.2±0.2	258.7±0.1	1.36±0.3
0.3		4.5±0.1	26.9±0.1	284.1±0.1	1.46±0.2		3.6±0.1	29.4±0.2	257.4±0.2	1.35±0.2
0.4		4.5±0.2	27.0±0.4	285.2±0.2	1.43±0.1		3.6±0.3	29.6±0.2	256.9±0.3	1.38±0.1
0.5		4.5±0.3	26.1±0.3	286.0±0.3	1.45±0.3		3.6±0.2	29.4±0.3	259.0±0.2	1.37±0.3
0.1	55	4.5±0.3	27.5±0.3	287.6±0.1	1.43±0.1	720	3.6±0.1	29.4±0.1	257.3±0.3	1.37±0.2
0.2		4.5±0.2	27.6±0.2	283.9±0.3	1.45±0.1		3.6±0.2	29.3±0.3	259.4±0.2	1.36±0.1
0.3		4.5±0.1	26.5±0.2	284.2±0.2	1.42±0.2		3.6±0.3	29.2±0.2	257.1±0.1	1.38±0.3
0.4		4.5±0.2	27.9±0.2	288.2±0.3	1.48±0.3		3.6±0.2	29.5±0.3	259.0±0.3	1.37±0.3
0.5		4.5±0.3	25.5±0.1	284.1±0.2	1.42±0.2		3.6±0.1	29.3±0.2	259.1±0.3	1.38±0.2
0.1	60	4.5±0.1	27.1±0.3	285.0±0.2	1.41±0.3	900	3.6±0.3	29.4±0.1	257.0±0.1	1.37±0.1
0.2		4.5±0.3	26.4±0.2	286.6±0.3	1.40±0.1		3.6±0.2	29.5±0.2	256.2±0.2	1.38±0.2
0.3		4.5±0.2	27.3±0.3	275.9±0.1	1.43±0.1		3.6±0.2	29.5±0.3	256.1±0.2	1.37±0.3
0.4		4.5±0.2	26.0±0.2	274.5±0.1	1.45±0.3		3.6±0.3	29.6±0.3	259.2±0.3	1.37±0.1
0.5		4.5±0.3	27.3±0.3	275.9±0.1	1.42±0.3		3.6±0.3	29.4±0.2	259.1±0.2	1.36±0.3

(7.8%) than those using with 0.1, 0.3, 0.4 and 0.5 % sodium bicarbonate (7.6, 7.3, 7.3 and 7.6 respectively). The ascorbic acid content due to the treatment with 0.2% sodium bicarbonate was slightly high (285.9 µg/g) than due to the treatment with 0.1, 0.3, 0.4 and 0.5% sodium bicarbonate (285.1, 285.4, 285.4 and 285.3 respectively µg/g). The sun dried powder using 0.2% of sodium bicarbonate was with more chlorophyll content (1.43%) than that dried with 0.1, 0.3, 0.4 and 0.5 % sodium bicarbonate (1.42, 1.42, 1.42 and 1.41% respectively). From the result it was concluded that sun drying using 0.2% sodium bicarbonate was better.

TABLE III. CHEMICAL ANALYSIS OF CURRY LEAVES POWDER USING SUN DRYING (SODIUM BICARBONATE)

Treatment (Sodium Bicarbonate)	Moisture (%)	Vit A (%)	Ascorbic acid (mg/g)	Chlorophyll content (%)
0.1	3.6±0.2	33.1±0.3	285.1±0.3	1.42±0.3
0.2	3.6±0.3	33.7±0.1	285.9±0.1	1.43±0.2
0.3	3.6±0.2	33.2±0.2	285.4±0.3	1.42±0.1
0.4	3.6±0.1	33.0±0.3	285.4±0.1	1.42±0.3

0.5	3.6±0.2	33.6±0.1	285.3±0.3	1.41±0.3
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#### CONCLUSION

It can be thus concluded that Microwave drying methods are best method of dehydration of curry leaves pretreated with Sodium bicarbonate. There was better retention of nutrients like ascorbic acid, vitamin A and chlorophyll contents and dehydrated characteristics as compared to sun drying and Tray drying.

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