

Study on the Drying Characteristics of Green Gram, Cowpea and Soybean

Jangabelli Mounika¹, Bhasker Vellanki², Thiruthopu Neelima³, Mrudula Guggilla⁴,
Srinivas Maloo⁵

^{1,3,4}M.Tech Food Technology, College of Technology, Osmania University, Telangana, India

Associate Professor², Assistant Professor⁵, Department of Food Technology, College of Technology, Osmania University, Telangana, India

Abstract— The study reveals the drying characteristics of Green gram, Cowpea and Soybean when exposed to two different drying mechanisms namely convective (i.e., Tray Drying) and a innovative method (i.e., microwave drying). The objective of the study is to come out with a most appropriate drying technique which gives the product a better keeping quality. In this study the drying characteristics i.e the amount of moisture removed for every 10min is calculated at different temperatures for the respective samples. The sample was dried in tray dryer and microwave at two temperatures.

Keywords—Drying, moisture content, keeping quality.

I. INTRODUCTION

Legumes are great sources of fat, protein and carbohydrates. Different varieties contain varying amounts of these nutrients, with beans, nuts, peas and lentils all having unique nutritional profiles. Drying is when you reduce the moisture in the legumes until it becomes safe to store the legumes. Dry legumes can be stored much longer than wet legumes. If you wait too long before drying the legume, if you don't dry the legume long enough, or if you dry the legume in a poor way, the quality of the legume will decrease fast.

Drying or dehydration of fruits and vegetables is an age old method to prevent the products. Removal of water (70-90%) present in the fresh commodity results in reduction in the water activity and ultimately resistance against most of the deteriorative agents. The terms drying refers to the removal of moisture from a substance. The word dehydration usually compiles the use of controlled conditions of heating, with the forced circulation of air and vacuum or any other artificial drying methods.

1.1 Why drying?

- Water acts as the main source for micro-organisms which deteriorates the quality of legumes by which reduces the keeping quality of legumes.

- Reduction in weight, size and volume of the legumes. Hence bulk transportation becomes easier and cheaper.
- Packaging requirements are simple and cheap.
- Facilitate further processing. Ex. Legume drying for flour.

1.2 Types of drying methods

1. Conventional: Sun drying, Hot air drying
2. Modern: Freeze drying, Vacuum drying, Spray drying, Osmotic dehydration etc.
3. Innovative: Microwave drying, Pulse electric field, Ultra sound.

The mung bean (*Vigna radiata*), alternatively known as the moong bean, green gram, or mung is a plant species in the legume family. The mung bean is mainly cultivated in Pakistan, India, China, Korea, and Southeast Asia. It is used as an ingredient in both savory and sweet dishes.

Cowpea (*Vigna unguiculata*), an annual legume, is also commonly referred to as southern pea, blackeye pea, crowder pea, lubia, niebe, coupe or frijole. Cowpea originated in Africa and is widely grown in Africa, Latin America, Southeast Asia and in the southern United States. Cowpea seed is a nutritious component in the human diet, as well as a nutritious livestock feed.

Glycine max, commonly known as soybean in North America or soya bean, is a species of legume native to East Asia, widely grown for its edible bean which has numerous uses. Fat-free (defatted) soybean meal is a significant and cheap source of protein for animal feeds and many packaged meals.

II. MATERIALS AND METHODS

Samples were procured from local market and are checked for the quality and sorted out depending in its quality which are used for further processing.

The legumes are soaked in 150ml water for about an hour and are allowed to drain all the water and are dried in tray drying/microwave drying. Soaking is a traditional practice that can positively impact the nutritional qualities of the product. Grains, beans, nuts and seeds can all add great

value and variety to the diet, yet they contain anti-nutrients particularly phytates and enzyme inhibitors – which detract from their nutritive value. Soaking also helps drying early without much nutritional losses. The initial weight of the sample is taken and allowed to soak for 1 hour and again it was weighed and kept in tray /microwave dryers.

2.1 Tray drying

The tray drier is initially pre-heated to the required temperature (70°C and 80°C). The weighed sample is spread out, generally quite thin on trays in which a way that the hot air moves evenly through all particles of the sample. Heating may be by an air current sweeping across the trays, by conduction from heated trays or heated shelves on which the trays lie, or by radiation from heated surfaces. Most tray dryers are heated by air, which removes the moist vapours.

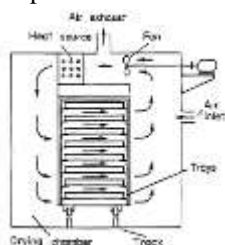


Fig.1: Tray drier

The weights of the sample is taken for every 10 minutes and the process is continued till constant reading is obtained and the amount of moisture removed is calculated.

2.2 Microwave drying

Microwave drying is a direct heat drying method. High frequency radio waves are utilized in microwave heating. Microwave energy doesn't heat the room, only the desired material with no harmful greenhouse gas emissions from the heat source. The energy is mainly absorbed by a wet material placed in the cavity. A domestic microwave operates at 2450 MHz (a wavelength of 12.24cm). Industrial/commercial microwave systems typically operated at 900 MHz (a wavelength of 32.68cm). This range allows more efficient penetration of the microwave through the material.

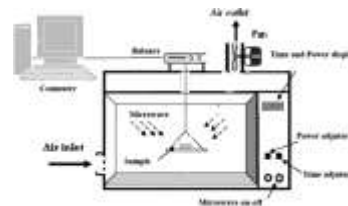


Fig.2: Microwave dryer

2.3 Product analysis :

Estimation of moisture content referred from Ref [4].

III. RESULTS AND DISCUSSIONS

The legumes are soaked for 30 minutes and the following data is obtained.

Table.1: Soaking of Green gram, Cowpea and Soybeans

Drier	Sample	Temperature (°C)	Initial weight (grams)	Soaking		Final weight (grams)
				Water(ml)	Time(min)	
Tray	Whole green gram	90	100	150	30	112.4
		100	100	150	30	109.2
	Cowpea	90	100	150	30	143.4
		100	100	150	30	143.4
	Soybean	90	100	150	30	125.6
		100	100	150	30	123.3
Microwave	Whole green gram	100	100	150	30	110.5
	Cowpea	100	100	150	30	142.5
	Soybean	100	100	150	30	120.6

Table.2: Drying data for whole green gram

Drier	Temperature (°C)	Moisture content removed for every 10 minutes (%)		
		Whole green gram	Cowpea	Soybean
Tray	90	9.7	17.15	13.21
		10.6	27.26	15.52
		11.6	30.33	16.78
		11.6	30.82	17.18
		-	30.82	17.18
	100	11.7	24.26	14.43
		11.9	26.84	15.81
		12.9	28.66	16.62
		13.3	30.19	17.27
		13.7	32.07	18.08
Microwave	100	13.7	32.07	18.08
		5.88	9.48	4.72
		8.1	14.19	7.63
		9.5	16.77	12
		9.5	19.67	16.36
		-	19.67	24
-	-	24		

IV. CONCLUSIONS

From the above study on dehydration of Whole green gram, Cowpea and Soybean, tray dried legumes at 100°C has shown better moisture removal content compared to the other conditions of drying with less time. Hence, it can be concluded that drying of legumes decreases the moisture content by which the deterioration decreases as water acts as main source of micro-organisms.

REFERENCES

[1] AOAC(1984) official methods of analysis 14th ed.Washington,DC,2014.
 [2] Andre's,A.,Bilbao,C., & Fito, P. (2004). Drying kinetics of apple cylinders under combined hot air microwave dehydration. Journal of Food Engineering,63,71e78.
 [3] Basem F. Dababneh., An innovative microwave process for microbial decontamination of spices and herbs. African Journal of Microbiology Research Vol. 7(8), pp. 636-645, 19 February,2013.
 [4] Chemistry of spices by V.A.Parthasarathy, Bhageerathy Chempakam, T. John Zachariah – 2008.
 [5] Food processing handbook, edited by James G. Brennan, Copyright © 2006 WILEY-VCH Verlag

GmbH & Co. KGaA, Weigheim ISBN: 3-527-30719-2.

[6] Handbook of Analysis and Quality control for fruits and vegetables by S.Ranganna.
 [7] Little CL, Omotoye R, Mitchell RT (2003). The microbiological quality of ready to eat foods with added spices. Int. J. Environ. Health Res. 13:31-42.
 [8] Mandeel QA (2005). Fungal contamination of spices and herbs: a review. Lebensm.Wiss.Technol. 28:1-11.
 [9] P. Gupta,J. Ahmed,U.S. Shivhare and G.S.V.Raghavan. (2002). Drying Characteristics of Red Chilli. Drying Technology Vol.20, No. 10,pp. 1975-1987-2002.
 [10] Peter VK (2001). Handbook of Herbs and Spices. Wood head Publishing LTD,Cambridge,UK.
 [11] Textbook of Microwave Processing of Foods, edited by Helmar Schubert and Marc Regier.
 [12] Textbook of Microbiology by Prof. C P Baveja,ISBN 81-7855-266-3.
 [13] Textbook of Microbiology by Ananthanarayan and Panikar, ISBN 81-250-2808-0.