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Short Communication

Effect of gamma irradiation on moisture sorption isotherms of cowpeas

Ashaye O. A.

Institute of Agricultural Research and Training, Obafemi Awolowo University, P.M.B 5029, Ibadan, Nigeria. E-mail: kayodeashaye@yahoo.com

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The effect of gamma irradiation on moisture sorption isotherms of cowpeas was investigated The non-irradiated and irradiated cowpeas exhibited the typical three stage sigmoidal curve found in most foods. There was also a concomitant increase in the equilibrium moisture content (EMC) as relative humidity increased for non- and irradiated cowpeas. Drum cowpea (15 Gy) had the highest rate of water absorption. Generally, the amount of water absorbed by irradiated cowpeas is generally higher than non-irradiated cowpeas.

Key words: Cowpea, irradiation, moisture, sorption.

INTRODUCTION

Cowpea (*Vigna unguiculata*) is a legume consumed in Nigeria and other West African Countries. Unlike animal sources, which are scarce and expensive, cowpea is an inexpensive source of protein and minerals. It serves as a key staple food for the poorest sector of many developing countries in the tropics (Singh and Rachie, 1985; Oyefeso, 1980). In Nigeria cowpea can be cooked plain, mixed with other foods or processed into formulated recipes. Also cowpeas have been made into various types of canned foods such as cooked beans, a deep fried product (akara) or a steamed product (moin-moin.).

The diversification in the use of cowpea in our various dishes will depend to a large extent on the effectiveness of the control of storage stability. The use of gamma irradiation in storability studies has gained acceptance in Nigeria, (Agbaji et al., 1981; Ogbadu 1980; Onyenekwe et al., 1997; Onyenekwe and Ogbadu, 1995). Hygroscopy of foods affects storage, handling and processing and valuable information on this and consequently the optimization of these components of the food chain can be deduced from moisture sorption characteristics of the food (Sopade et al., 1996). There is presently no information on the moisture sorption characteristics of gamma irradiated cowpeas and this study was carried out to provide this. This would be useful in monitoring storage and handling behaviour especially in hot and humid tropics and in controlling post-harvest losses.

MATERIALS AND METHODS

Procurement and handling of grains

Freshly harvested cowpea variety Ife brown was obtained from experimental research farm at the Institute of Agricultural Research and Training (I.A.R.&T) Ibadan while Kano white and Drum varieties were obtained from the research farm at Premier seeds Nigeria (LTD) Zaria. The grains were harvested from the experimental research farms when their pods are dry. The harvested grains were sorted to remove damaged grains and extraneous matter such as stones and chaff and then packed in low-density polyethylene bags of 5 Kg capacity

Gamma Irradiation of cowpeas

The packaged beans were irradiated at 0, 5, 10 and 15 Gy at ambient temperature (27±1°C) in a Cobalt-60 Gamma cell 220 (AEC Model) having an influx of 0.10556 Gy/s, located at the centre for Energy Research and Development, Obafemi Awolowo University, Ile-Ife.

Water absorption Isotherm

Water absorption isotherm was determined by gravimetric method (Labuza, 1984) using the salts proposed by Rockland (1960). Samples were conditioned to a constant weight over 96% concentrated sulphuric acid for 2 weeks before the rate of water absorption was determined. Duplicate samples of 5 g each, were placed in the upper section of each glass desiccator on wire mesh,

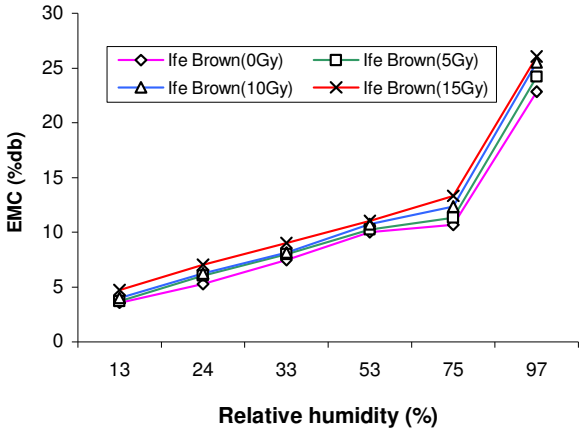

Figure 1. Water absorption isotherm of irradiated and non-irradiated Ife brown cowpea stored at 27°C.

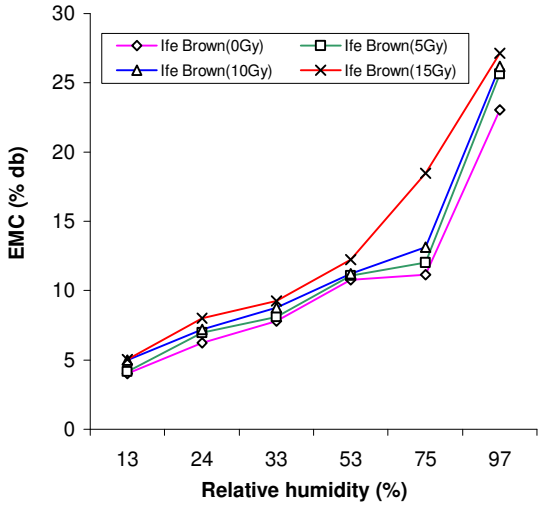

Figure 2. Water absorption isotherm of irradiated and non-irradiated Ife brown cowpea stored at 18°C.

while the lower section contained saturated salt solution. The salts were lithium chloride, potassium acetate, magnesium chloride, magnesium nitrate, sodium chloride and potassium sulphate (analytical grade) ranging from (13-97%). After insertion of the samples and salts, the dessicators were independently sealed with silicone grease and placed at temperatures 18 and 27°C. The relative humidity values of the salts at these temperatures were obtained by interpolation from Rockland (1960). The samples were weighed at intervals of 12 h until equilibrium was reached when four consecutive measurements gave the same readings and this normally took 20-25 days. A plot of % rate of water absorption against % relative humidity gave their corresponding water absorption isotherm (Labuza, 1984).

RESULTS AND DISCUSSION

Figures 1-6 show the rate of water absorption of non-irradiated and irradiated Ife Brown, Kano white and Drum cowpea varieties at two temperatures, 18 and 27°C. The non-irradiated cowpeas exhibited the typical three stage

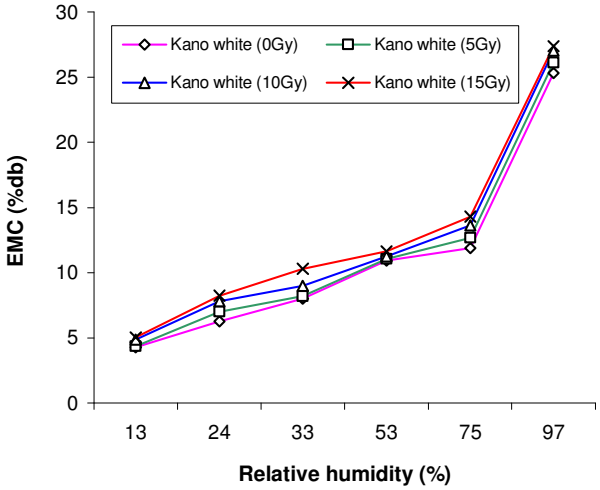

Figure 3. Water absorption isotherm of irradiated and non-irradiated Kano white cowpea stored at 27°C.

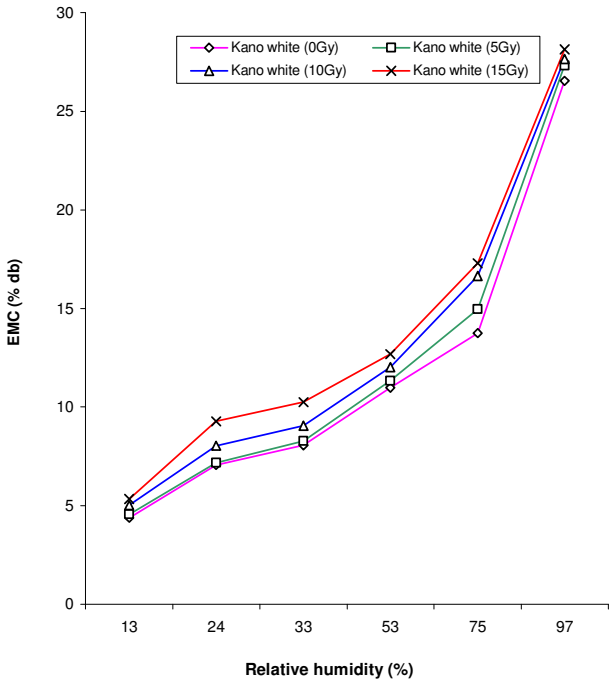

Figure 4. Water absorption isotherm of irradiated and non-irradiated Kano white cowpea stored at 18°C.

sigmoidal curve found in most foods. There was also a concomitant increase in the equilibrium moisture content (EMC) as relative humidity increased. Non-irradiated drum cowpea (Figures 5 and 6) has the highest rate of water absorption. This trend agrees with published studies (Ajibola et al., 2003; Denloye and Adejohn, 1983). Generally, the amount of water absorbed by irradiated cowpeas is generally higher than non-irradiated cowpeas. Gamma irradiation weakens the intermolecular bonds

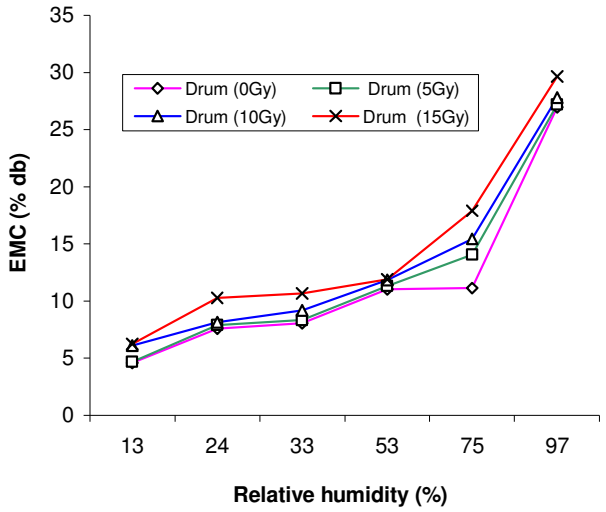

Figure 5. Water absorption isotherm of irradiated and non-irradiated Drum cowpea stored at 27°C.

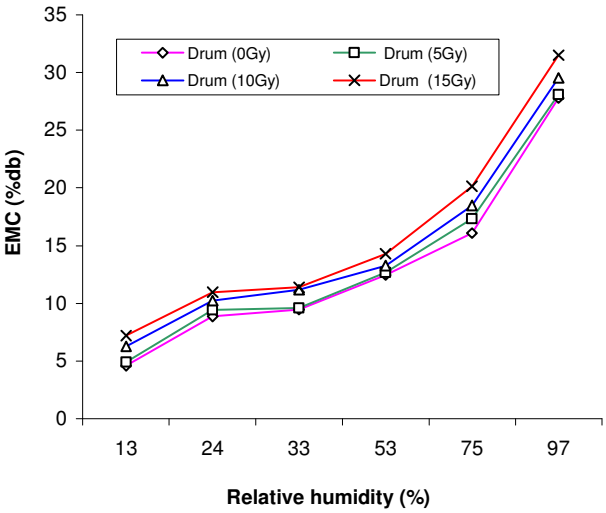

Figure 6. Water absorption isotherm of irradiated and non-irradiated Drum cowpea stored at 18°C.

between starch and water thereby enhancing increase in water uptake (Rao and Vakil, 1985). Storage of these cowpeas at relative humidities up to 60% could be adjudged to be safe for storage purposes.

In conclusion, the study of the sorption revealed that, like most foods, cowpea exhibited the sigmoid pattern irrespective of the environmental temperature. It also describes the hygroscopic nature of the irradiated cowpeas.

REFERENCES

Agbaji AS, Ogbadu GH, Van Amstel H (1981). Effect of gamma irradiation on the keeping quality of Nigerian onion cultivars. Radiation Physics and Chemistry 17: 189-194

Ajibola OO, Aviara NA, OE Ajetumobi (2003). Sorption equilibrium and thermodynamic properties of cowpea(*Vigna unguiculata*) J. Food Engin. 54: 4 317-324.

Denloye AO, Adejohn AO (1983). Moisture sorption isotherms of some Nigerian food grains. J. Stored Prod. Res. 21, 2: 53-58.

Labuza TP (1984). Moisture sorption: practical aspects of isotherm measurement and use. St. Paul, Minnisota American Association of Cereal Chemists. pp. 2-8.

Ogbadu GH (1980). Effect of gamma irradiation on Aflatoxin B1, production by Aspergillus flavus (UI 81) growing on some Nigerian food stuffs. Microbios. 27: 19-26.

Onyenekwe PC, Ogbadu GH (1995). Radiation sterilization of Red chilli peper (*Capsicum fruteseens*). J. Food Biochem. 19: 121-137.

Onyenekwe PC, Ogbadu GH, Hashimoto S (1997). The effect of gamma irradiation on the microflora and essential oil of Ashanti pepper (Piper guineense) berries. Post Harvest Biology and Technology 10: 161-167.

Oyefeso JA (1980). Studies on the effect of traditional culinary methods on the digestibility of local cowpea (*Vigna Unguiculata*) protein PhD College of Medicine University of Lagos. pp. 1-76.

Rao VS, Vakil UK (1985). Effect of gamma irradiation on cooking quality and sensory attributes of four legumes J. Food Sci. 50: 372-374.

Rockland LB (1960). Saturated salt solutions for static control of relative humidity between 5°C and 40°C. Analytical Chemistry. 32, 10:1375-1376.

Sopade PA, Ajisegiri ES, Abass AB (1996). Moisture sorption isotherm of kilishi, a traditional Nigerian meat product ASEAN Food J. 10: 1:1-2.

Singh SR, Rachie KO (1985). Cowpea: Research, production and utilization Publisher Wiley-Interscience. Printed in Great Britain. p. 66.