EFFECT OF FRYING CONDITIONS ON MOISTURE AND FAT OF PAPADS

M. M. RAHMAN[1] AND M. B. UDDIN[2]

[1] MS student, Department of Food Technology and Rural Industries, Bangladesh Agricultural University, Mymensingh-2202 [2]Professor, Department of Food Technology and Rural Industries, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh.

Accepted for publication: November 25, 2007

ABSTRACT

Rahman M. M. and Uddin M. B. 2008. *Effect of Frying Conditions on Moisture and Fat of Papads.* **Int. J. Sustain. Crop Prod. 3(2): 16-21**

The study was conducted in the Laboratories of the Department of Food Technology and Rural Industries, Bangladesh Agricultural University (BAU), Mymensingh to determine the relations in moisture content, fat content and frying conditions. Papads were prepared from Mungbean, Grasspea (Khasari dal), Black gram (Mashkolai dal) incorporating soya flour. All the ingredients were collected from the local market. Five different types of papads were prepared using 0%, 5%, 10%, 15%, 20% soya flour with pulses and other ingredients. The products were analyzed for proximate composition, studied the effects of processing time and temperature on the quality of soya papads. The moisture and fat content in the dried papads samples were found in the range of 10.10 to 10.33% and 1.06 to 5.35% respectively. A sharp increase in fat content was observed with the increase of soya flour in the papads. The fried soya papads contained 2-3% moisture, 0.4-0.6% ash, 26-36% fat, 28-30% protein and 33.4-42.9% total carbohydrate. The result showed that minimum frying time for dried papads required to reach desired final moisture content of 2-2.5% was 22 sec. at 170^{0}C, 18 sec. at 180^{0}C and 11 sec. at 190^{0}C. The oil content of papads were found to be 23% at 170^{0}C, 20% at 180^{0}C and 16% at 190^{0}C when the moisture content of papads varied from 2-2.5%..

Key ward: Frying conditions, moisture and fat content, papads

INTRODUCTION

Soybeans(s) (US) or soy bean (UK) a legume, the botanical name of which is *Glycine max* (L.) Merrill. It is a summer annual varying in height from less than a food to more than 6 feet with a growth habit from stiffly erect to prostrate; cultivated varieties (cultivar) may reach a height of 3 feet or more; the seeds (soybeans) are borne in hairy-pods that grow in clusters of three to five with each pod usually containing 2 or 3 or more seeds. Soybean (*Glycine max* L.) a self-pollinated crop is one of the most important oil and protein crops of the world. Oil and protein rich soybean has now been recognized all over the world: as a potential supplementary source of edible oil and nutrition (Kaul and Das, 1986). This can play a vital role in balancing the protein-calorie malnutrition in Bangladesh diet. The oil of soybean contains 85% unsaturated fatty acid and is cholesterol free. The soybean is an excellent source of major nutrients including a good source of vitamins and minerals. Besides producing oil, the seeds of soybean are also used for producing many of the food dishes, confectioneries, baby foods and soybean milk. Soybean seeds contain 43.2% protein, 19.5% fat, 20.9% carbohydrate and a good amount of other nutrients like calcium, phosphorus, iron and vitamins (Gopalan *et al*., 1971). Soybean is used mainly for edible oil. Because of its protein content soybean is used in China in different foods and beverage. In terms of protein production per hectare, soybean has the highest yield (800 kg) at the lowest price and compared with all other vegetable proteins, its amino acid composition is one of the best. Soybean have a content of approximately 40-45% high valued protein and 20-22% high valued oil and can be considered to be a concentrated protein food. Soybean has 3% lecithin which is helpful for brain development. It is also enriched in Ca, P, Vit A, B, C and D (Rahman, 1982). If the beans are cleaned and dried to a moisture content of less than 12%, then these can be stored for a year without any significant loss in quality. The oil of soybean contains 85% unsaturated fatty acid and is cholesterol free. In oil and protein bearing crops, oil and protein content has got negative relationship (Lat *et al*., 1973). The protein of soybean is called a complete protein as because it supplies sufficient amount of various kinds of amino acids required for body building and repairing the body tissues. Its food value in heart disease and diabetes is well known. Soybean oil contains a large amount of lecithin and a fair amount of fat soluble vitamins. Lecithin is an important constituent of all organs in human body and specially of the nervous tissue, the heart and lever. That is why soybean is a very good food (Krishnamurthy and Shivashankar, 1975). The present study illustrated the effect of frying conditions on moisture and fat of papads with a view to determine the relations in moisture content, fat content and frying conditions.

MATERIALS AND METHODS

The study was conducted in the Laboratories of the Department of Food Technology and Rural Industries, Bangladesh Agricultural University (BAU), Mymensingh. The soybean used in the study was collected from Bangladesh Seed Foundation, Mymensingh.

Soya flour

Soya flour was processed from the straw yellow varieties of soyabeans, free from immature, field damage and black soybeans. Using grain cleaners, the foreign materials were removed. Heavy aspiration removed loose hulls, weed seeds and other light foreign matter. The clean and fresh soybean seeds were then soaked in water [water contained 0.25-0.5% sodium bicarbonate ($NaHCO_3$)] for several (12-16) hours and heated at 70°C for 10 minutes. The main purpose of using $NaHCO_3$ was to remove the bitterness and anti-nutritional factors. The hulls were then removed and dried the dehulled soybean and grinded in a huller mill. The soya flour was packed in a high-density polythene bags, sealed and stored.

Black gram flour (Mashkoli dhal)

Black gram flour was processed which free from immature and field damage. Using grain cleaner, the foreign materials were removed. The clean and fresh black gram grinded in a huller mill. The black gram flour was packed in a high-density polythene bags, sealed and stored.

Mung flour (Mungbean dhal)

Mungflour (10.1% moisture and 24.5% protein) used in the study was commercial mung flour (Norani Flour Ltd, 277 Tejgaon Industrial Area, Dhaka).

Grasspea flour (Khasari dhal)

Khasari flour was processed from BARI khasari-1 varieties, free from immature and field damage. Using grain cleaner, the foreign materials were removed. The clean and fresh grasspea flour grinded in a huller mill. The grasspea flour was packed in a high-density polythene bags, sealed and stored.

Chemicals, solvents and ingredients

Chemicals and solvents used in the study were of analytical reagent grade and water was glass-distilled unless specified otherwise. Black cumin, cumin, mungbean, grasspea, baking powder, salt and other ingredients were procured from the local market. High-density polythene was used for package and storage of samples. Other ingredients were used from laboratory stocks.

Basic formulation of papads

Five different types of papads were prepared according to the composition given in Table 1.

Table 1. Formulas of papads

Ingredients	Samples				
	S_1 (control)	S_2	S_3	S_4	S_5
Grasspea dhal (Khasari dhal)	50 g	50 g	50 g	40 g	45 g
Mungbean dhal	25 g	25 g	20 g	30 g	20 g
Black gram dhal (Mashkolai dhal)	25 g	20 g	20 g	25 g	15 g
Soya flour	0 g	5 g	10 g	15 g	20 g
Black cumin	0.5 g	0.5 g	0.5 g	0.5 g	0.5 g
Cumin	0.5 g	0.5 g	0.5 g	0.5 g	0.5 g
Black pepper	0.5 g	0.5 g	0.5 g	0.5 g	0.5 g
Baking powder	1.2 g	1.2 g	1.2 g	1.2 g	1.2 g
Mustard oil	12.5 g	12.5 g	12.5 g	12.5 g	12.5 g
Common salt	0.6 g	0.6 g	0.6 g	0.6 g	0.6 g
Water	50 g	50 g	50 g	50 g	50 g

Preparation of papads from soya flour

Papad is an important snack food item prepared from the flour. The preparation involves gelatinisation of the soy flour with minimum quantity of water. The soya flour was mixed with requisite quantity of other ingredients as shown in Table 1. All the ingredients were mixed in a mixture to make a dough. After 30 min. resting the dough was divided into balls of about 2-3 cm dia weighing 5-6 gm. These are rolled into thin circular discs of about 1 mm thickness using rolling pin. The papads were dried in drier at 50^0C. The dried papads at this stage contained about 14-15% of moisture. The dried papads were then packed in polythene bags. These dried papads are consumed by deep frying in oil. The final products usually undergo 2-3 times expansion on frying. It is crisp and can be consumed as a side dish. The preparation of soya papads is presented in the following flow chart.

Mixing (All the ingredients)
↓
Doughing
↓
Making small round shape dough
↓
Rolling
↓
Drying in the drier (50^0C-1 hr)
↓
Packaging
↓
Frying

Flow chart for production of soya papads

RESULTS AND DISCUSSION

Processing of fried papad

Determination of the ratio of papads to oil

Soya papads were fried at oil temperature of 170^0C, 180^0C and 190^0C. The preliminary study showed that the satisfactory frying was obtained by frying at 170^0C to 180^0C. To maintain these desired temperatures papad to oil ratio was chosen to give an initial temperature drop of 10^0C. Papads were placed in hot oil when the temperature was 5^0C higher than the set temperature. For determination papads to oil ratio by trial and error method, different ratio of papads to oil such as 1:10, 1:15, 1:20, 1:25, 1:30 were chosen. Papads to oil ratio of 1:20 gave the lowest and desired temperature drop i.e. 10^0C. During potato chips frying also gave the potato to oil ratio was found to be 1:25 (Ali, 1997). In all cases (i.e. 170^0C, 180^0C, 190^0C) same initial temperature drop was observed. It was however, observed that in the case of higher temperature, temperature quickly returned to original temperature than for the cases of relatively lower temperature. This is understandable since higher temperature give higher sensible heat content than lower temperature for a constant mass of oil and material as predicted by sensible heat gain equation i.e. mass × specific heat × temperature gain. Finally the most acceptable papads to oil ratio and temperature drop were 1:20 and 10^0C respectively. Similar observation was found at potato chips processing Ali (1997).

Moisture content of fried soya papads

Moisture content of samples undergoing frying was determined at different time interval for various frying oil temperatures such as 170^0C, 180^0C and 190^0C. Moisture content of papads during frying at different temperature is shown in Figure 1.

The moisture content (Figure 1) follows a linear relation with time for the greater part of the frying period for all cases of frying temperature. An analysis of the data showed that rate of water removal depends on temperature and the higher the temperature, the higher the rate of water removal. However, the rate of moisture removal from papads at the initial period was the highest. For longer shelf-life, the moisture contents should be minimum. There was no finding regarding moisture content of fried soya papads. In case of fried soya papads of the present study 2-3% moisture content was taken as minimum. The results also show that to achieve 2-3% moisture content in papads frying time should be 22 second at 170^0C, 18 second at 180^0C and 10 second at 190^0C.

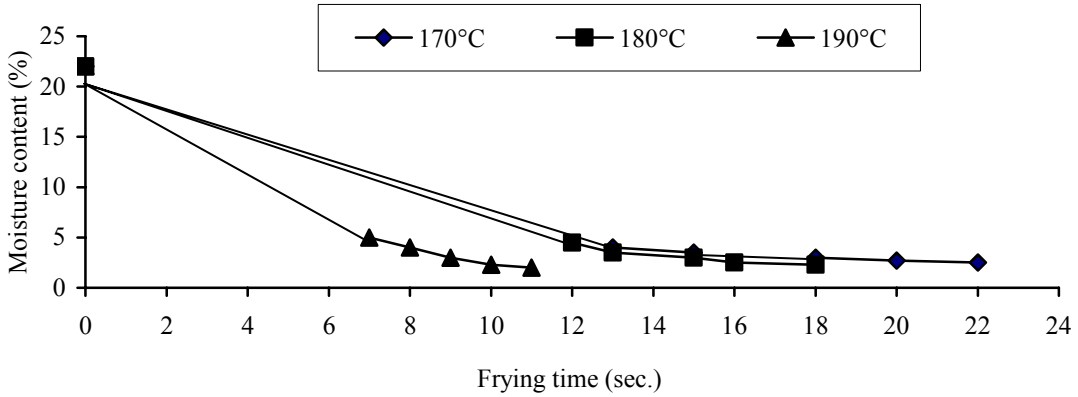

Figure 1. Effect of frying temperature on the moisture content of soy papads (basic formulation)

Table 2. Influence of time and temperature of frying on moisture content and oil content of fried soya papads (basic formulation)

Frying temperature (^{0}C)	Frying time (Second)	Moisture content (%)	Oil content (%)
170	22.0	2.5	23
	20.0	2.7	21
	18.0	3.0	19
	15.0	3.5	16
	13.0	4.0	15
180	18.0	2.3	20
	16.0	2.5	18
	15.0	3.0	16
	13.0	3.5	15
	12.0	4.5	13
190	11.0	2.0	16
	10.0	2.3	14
	9.0	3.0	13
	8.0	2.5	12
	7.0	3.0	10

Oil content of fried soya papads

From the economic point of view, oil content of papads should be as low as possible. So determination of oil content of papads is essential. An experiment was conducted to show the time dependence of oil content of soya papads at different frying temperatures such as 170^{0}C, 180^{0}C and 190^{0}C. The results are depicted in Figure 2. It can be seen from Figure 2 that oil content of soya papads increased with increasing frying time for all frying temperature. However, the rate of oil uptake, at the initial period was highest for the highest temperature and lowest for the lowest frying temperature indicating that rate of oil uptake is dependent on temperature.

Frying of soya papads can be considered as a two way diffusion process in which water is removed due to evaporation by heat transferred from hot oil, while the hot fat is diffused into the papads filling the space emptied by water (Ali, 1997). It was well known that diffusion process is strongly dependent on temperature Arrhenius type of relationship.

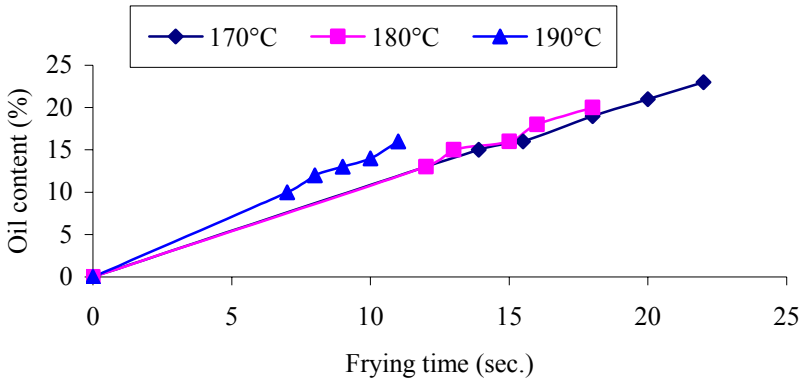

Figure 2. Effect of frying temperarure on the oil content of the soy papads (basic formulation)

Relationship between oil content and moisture content of soya papads during frying

As indicated in the previous section that frying of soya papads is a two way diffusion process. The experimental results of frying the papads at constant temperature and determining both moisture content and fat content of frying papads at definite time interval (as shown in the Table 2). The results of the analysis are shown in Figure 3. It is clearly seen that decrease in moisture content gives increased oil uptake indicating that water in cassava papads is replaced by frying fat. However, the rate of uptake of fat is far less than the rate of moisture removal. This is understandable since the water molecules are much smaller than the fat molecules and thus diffusion co-efficient for water removal is much higher than that of fat uptake at a constant temperature. Similar analysis was given by Ali (1997) for potato chip processing. From Figure 3 it is also seen that at the moisture content of about 2-3% oil content in the papads varies between 16-30% for all frying temperatures such as 170^{0}C, 180^{0}C and 190^{0}C. It is also observed that the higher the moisture contents the lower the oil content III all cases. The oil uptake rate is slightly higher at the higher temperature.

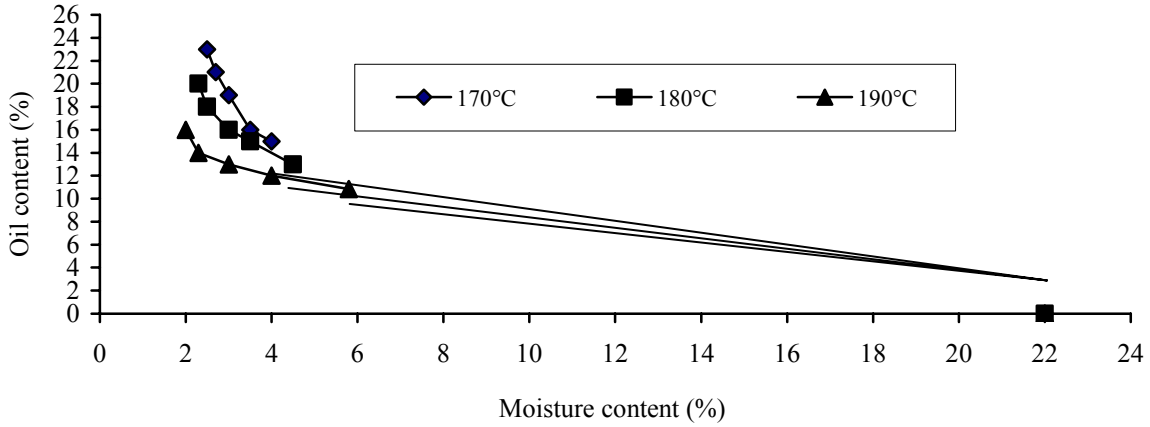

Figure 3. Relation between oil content and moisture content of fried soy papads (basic formulation) at various frying temperature

CONCLUSION

The oil content of papads was found to be 33% at 170^{0}C, 30% at 180^{0}C and 26% at 190^{0}C when the moisture content of papads was 2-3%. Frying of soya papads can be considered as a two way diffusion process in which water is removed due to evaporation by heat transferred from hot oil, while the hot fat is diffused into the papads filling the space emptied by water.

The findings of this study revealed that moisture content decrease with frying time increase and oil content increase with frying time increase. On the other hand, oil content decrease when frying time and moisture content decrease.

REFERENCES

Ali, M.H. 1997. Processing and storage studies of potato chips. M.S. Thesis, Department of Food Technology, Bangladesh Agricultural University, Mymensingh.

Gopalan, C., Sastri, R.B.V. and Balasubramanian, S.C. 1971. Nutritive value of Indian Foods. I.C.M.R., Hydrabad, India, reterred by smith, R.G., Home Economist, MCC.

Kaul, A.K. and Das, M.L. 1986. Oil seed in Bangladesh. Ministry of Agriculture, Dhaka.

Krishnamurthy, K. and Shivashankar, K. 1975. Soybean Production in Karnataka USA, Tech. Series No. 12, Bangalore, University of Agricultural Sciences.

Lat, M.S., Mehta, S.K., Deodhar, A.D. and Shanama, Y.K. 1973. Protein and oil content, their correlation and phonetypic environments in Madhya Pradesh. Indian J. Agril. Sci., 43(1): 14-17

Rahman, L. 1982. Cultivation of soybean and its uses. Printed by The City Press, Dhaka and Published by Dr. Lutfur Rahman, Bangladesh Agricultural Research Council, Bangladesh. pp. 5-7