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Effect of Blanching (time and temperature) and Frying Temperatures on The Oil Uptake and Texture of Chips Prepared From Elephant Foot Yam (*Amorphophallus Paeoniifolius*)

U.Kaushik[1], R.N Shukla[2], Avanish Kumar[3], A.A Mishra[4], W. Elizabeth Devi[5]

[1,5] M.Tech Food Technology, Department of Food Process Engineering, Vaugh school of agriculture Engineering and Technology, Sam Higginbottom Institute of Agriculture, Technology & Sciences
P.O Naini, Allahabad,U.P. 211007, INDIA

[2,3,4] Assistant Professor, Department of Food Process Engineering, Vaugh school of agriculture Engineering and Technology, Sam Higginbottom Institute of Agriculture, Technology & Sciences
P.O Naini, Allahabad,U.P. 211007, INDIA

Abstract

The study was conducted to investigate the effect of processing operations including the pre-treatments like blanching and the frying oil temperatures on the quality parameters of the fried product like the oil uptake and texture. Studies were conducted using three levels of blanching temperature and time as well as three levels of frying oil temperatures. After blanching the samples were dried up to a moisture content of 8.78±0.6 (wet basis). Results showed that the oil uptake and the textural property of hardness varied according to the type of processing conditions employed for sample preparation. The oil uptake was the lowest for the sample blanched at 80˚C for 8 minutes and fried at the oil temperature of 160˚C(5.95g/100g) and highest for the sample blanched at 70˚C for 2 minutes and fried at 180˚C(11.65g/100g). Textural analysis shows the highest amount of hardness for sample processed at 80˚C for 8 minutes of blanching followed by 160˚C frying temperature and lowest at 90˚C for 8 minutes of blanching and fried at 180˚C.

Keywords: *Blanching Temperature and Time,Frying Temperature, Oil Uptake, Texture Analysis.*

1. Introduction

Elephant foot yam (*Amorphophalus Paeoniifolius*) grows in wild form in Phillipines, Malaysia and other south east Asian countries. In India it is popular in states like Kerala, Andhra Pradesh and Maharashtra. It is a low fat food, loaded with essential amino acids and rich in fibre and has a low glycemic index making it idle for diabetics. Thus the need to make value added items from yam are highly desirable taking into account an increased craving among consumers for new product. Elephant yam can be processed to snack foods like chips which is a deep fried product and thus has enormous potential in the snack food industry.

Deep fat frying is a simultaneous heat and mass transfer operation in which the product is supplied heat through the frying oil as the heat transfer mechanism. Heat transfer involves convection from the oil to food and conduction within the food. Oil on coming into contact with the food causes the surface water to evaporate fast resulting in the formation of a thick crust containing a porous structure and responsible for the crispiness of fried product. Numerous researches have been done to explain the proper mechanism of the frying process and the oil uptake during the frying process. **Saguy and Pinthus(1995)** reported that loss of moisture is directly proportional to the square root of frying time and that oil uptake occurs as the moisture is removed from the food. According to the works of **Farkas et al., (1996)** oil uptake can be divided to three phases initial heating, surface boiling, falling rate and bubble end point. Oil absorbed by products can be classified into 3 types namely structural oil, penetrated surface oil and surface oil **(Bouchon et al., 2003). Moreira et al., (1997)** suggested that the oil uptake was mostly a post frying phenomena and 64% of the oil uptake took place during the cooling phase.

The oil absorbed by fried product has been a subject of much discussion as obesity has been a matter of serious concern in the present society. In some cases the oil uptake in fried products can go up to one third by weight **(Mellemma, 2003)**. Obesity has numerous adverse health effects like hypertension, diabetes and cerebral stroke. Hence the need to optimize the processing conditions resulting in the least oil uptake has been deemed necessary. Thus the present study was undertaken to analyze the effect of processing parameters like blanching and deep fat frying on the characteristics of the fried product like oil uptake and texture of elephant yam chips.

2. Materials and Methods

2.1 Sample Preparation

The elephant yam of a particular cultivar was purchased from the local market taking due care that it was in a good condition not affected by damage and spoilage. After procurement the raw material was adequately washed to remove soil and dust adhering on the surface. After that the raw material was cut into several pieces in order to facilitate the subsequent slicing. After cutting to small pieces the slicing was done using a hand slicer. The slices were then washed thoroughly in order to remove the excess starch on the surface. Next blanching of all the samples was done at the temperature levels of 70, 80 and 90˚C for time periods of 2, 4 and 8 minutes in a hot water bath which is thermostatically controlled. After blanching the samples were immediately cooled to prevent over blanching. Then the sample were evenly spread on the trays and kept inside the tray drier for drying. The samples were dried at 70˚C until reaching moisture content of 8.78±0.6 wet basis. After drying the samples were fried in a deep fat fryer which is thermostatically controlled at the frying oil temperatures of 160, 170 and 180˚C. Refined soyabean oil was used as the frying oil. After deep fat frying samples were taken out and allowed to cool. After cooling they were stored in aluminium pouches for subsequent analysis.

2.2 Sample Analysis

Sample analysis involved the analysis of the oil uptake and the texture of each sample. The oil uptake for each sample was measured with the help of a Soxhlet apparatus. Textural property of hardness was analyzed with a texture analyzer-Texture Exponent Lite,version 4,0,13,0 Texture Analyzer using a spherical probe which displays the response in the form of a force versus time graph.

3. Results and Discussions

3.1 Effect on the Oil Uptake

3.1.1 Effect of frying oil temperatures on the oil uptake of chips blanched at 70˚C.

The oil uptake was found to be 10.53, 11.6 and 11.65 g/100g for 2 minutes of blanching followed by frying at 160,170 and 180˚C. The oil uptake was found to be 9.82,11.46 and 11.61 g/100g when blanched for 4 minutes followed by frying in oil at temperatures of 160,170 and 180˚C.For 8 minutes of blanching at frying oil temperatures of 160, 170 and 180˚C the oil uptake was found to be 7.58,9.21 and 10.75 g/100g. Thus oil uptake was shown to increase with increase in frying oil temperatures. Similar type of results has been reported from the literature of **Garoyo and Moreira, (2002).** The linear regression equation for samples blanched at 70˚C for 2,4 and 8 minutes followed by frying at 160, 170 and 180˚C is given in equations 3.1, 3.2 and 3.3 respectively. The oil uptake for all the samples was significantly lower than the control or the unblanched samples fried at 160, 170 and 180˚C (oil uptake being 13.95, 14.78 and 15.78 g/100g respectively).

$$Y=0.56X+10.14 \quad \text{....Eqn. (3.1)}$$
$$Y=O.895X+9.1733 \quad \text{....Eqn. (3.2)}$$
$$Y=1.585X+6.01 \quad \text{....Eqn. (3.3)}$$

The graphical representation for the results is given in figure 3.1.

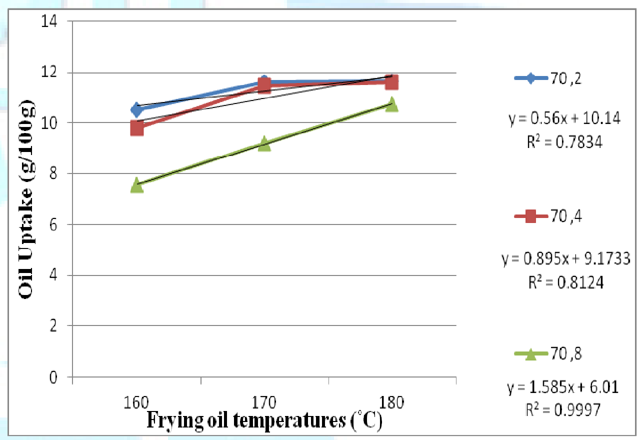

Figure 3.1 Effect of frying temperatures for samples blanched at 70˚C for 2, 4 and 8 minutes.

3.1.2 Effect of frying oil temperatures on the oil uptake of chips blanched at 80˚C.

The blanching pretreatment was carried out at a temperature of 80˚C for 2, 4 and 8 minutes. Then frying was carried out at temperatures of 160,170 and 180˚C. The oil uptake was found to be 10.04, 11.45 and 11.58 g/100g for 2 minutes of blanching followed by frying at 160,170 and 180˚C. The oil uptake was found to be 9.7, 10.16 and 11.06 g/100g when blanched for 4 minutes followed by frying in oil at temperatures of 160,170 and 180˚C. For 8 minutes of blanching at frying oil temperatures of 160, 170 and 180˚C the oil uptake was found to be 5.95, 7.55 and 8.96 g/100g. Thus oil uptake was found to increase with increase in the frying oil temperatures. The oil uptake for all the samples was significantly lower than the control or the unblanched samples fried at 160, 170 and 180˚C (oil uptake being 13.95, 14.78 and 15.78 g/100g respectively).

The linear regression equation for samples blanched for 2, 4 and 8 minutes followed by frying at 160, 170 and 180˚C is given in equations 3.4, 3.5 and 3.6 respectively.

Y=0.77X+9.4833 ...Eqn.(3.4)

.Y=0.68X+8.9467 ….Eqn.(3.5)

Y=1.505X+4.4767 ….Eqn.(3.6)

The graphical representation for the results is given in figure 3.2.

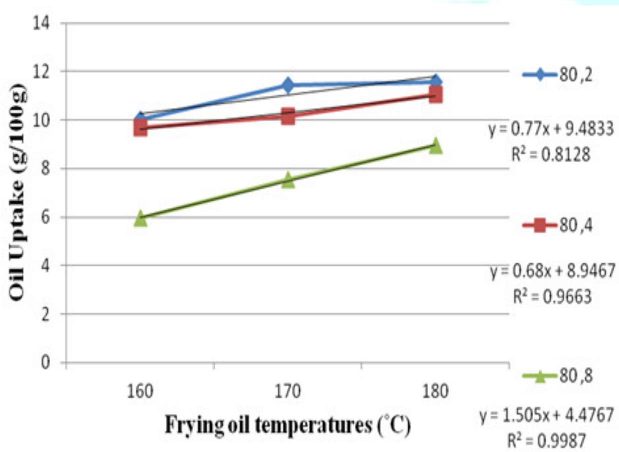

Figure 3.2 Effect of frying temperatures for samples blanched at 80˚C for 2, 4 and 8 minutes.

3.1.3 Effect of frying oil temperature on the oil uptake of chips blanched at 90˚C.

The oil uptake was found to be 7.75, 9.25 and 10.62 g/100g for 2 minutes of blanching followed by frying at 160,170 and 180˚C. The oil uptake was found to be 7.72, 7.78 and 8.31g/100g when blanched for 4 minutes followed by frying in oil at temperatures of 160,170 and 180˚C. However for 8 minutes of blanching at frying oil temperatures of 160, 170 and 180˚C the fat content was found to be 7.65, 6.75 and 6.05 g/100g. Thus oil uptake was found to decrease with increase in the frying oil temperatures when blanching was carried out at 90˚C for 8 minutes. The oil uptake was significantly reduced than the control or the unblanched sample (13.95, 14.78 and 15.48g/100g).

The linear regression equation for samples blanched for 2, 4 and 8 minutes followed by frying at 160, 170 and 180˚C is given in equations 3.7, 3.8 and 3.9 respectively.

Y=1.435X+6.3367 ….Eqn.(3.7)

Y=0.295X+7.3467 ….Eqn.(3.8)

Y=-0.8X+8.4167 ….Eqn.(3.9)

The graphical representation for the results is given in figure 3.3.

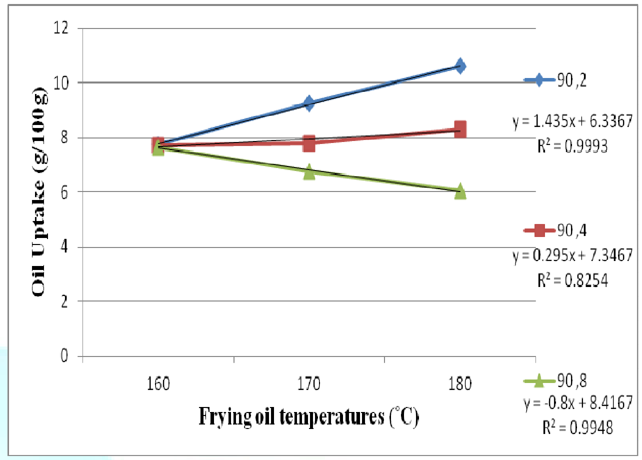

Figure 3.3 Effect of frying temperatures for samples blanched at 90˚C for 2, 4 and 8 minutes

3.1.4 Effect of blanching temperatures on the oil uptake of chips fried at 160˚C.

The oil uptake was found to be 10.53, 10.04 and 7.75 g/100g for a constant blanching period of 2 minutes and blanching temperatures of 70, 80 and 90˚C. The oil uptake was found to be 9.82, 9.7 and 7.72 g/100g for the constant blanching period of 4 minutes and blanching temperatures of 70, 80 and 90˚C. The oil uptake was found to be 7.58, 5.95 and 7.65g/100g for the blanching period of 8 minutes and blanching temperatures of 70, 80 and 90˚C. A critical observation shows that an increase in the temperature of blanching causes a decrease in the oil uptake at a constant frying temperature for 2 and 4 minutes. When blanched for 8 minutes the oil uptake initially decreased as the temperature of blanching was increased from 70 to 80˚C. Thereafter at 90˚C the oil uptake increased. The oil uptake was significantly lower than the control or the unblanched sample at 160˚C frying temperature (oil uptake being 13.95g/100g).

The linear regression equations for 70, 80 and 90˚C blanching are given in equations 3.10, 3.11 and 3.12.

Y=-1.39X+12.22 ….Eqn.(3.10)

Y=-1.05X+11.18 ….Eqn.(3.11)

Y=0.035X+6.99 ….Eqn.(3.12)

The graphical representation for the results is given in figure 3.4

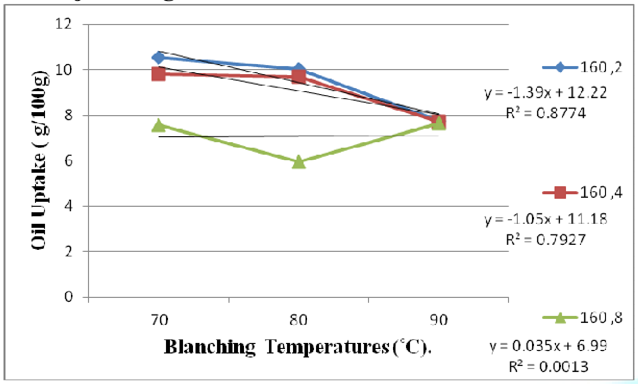

Figure 3.4 Effect of blanching temperatures for samples fried at 160˚C for 2, 4 and 8 minutes of blanching.

3.1.5 Effect of blanching temperatures on the oil uptake of chips fried at 170˚C.

The oil uptake was found to be 11.6, 11.45 and 9.25 g/100g for a constant blanching period of 2 minutes and blanching temperatures of 70, 80 and 90˚C. The oil uptake was found to be 11.46, 10.16 and 7.78 g/100g for the constant blanching period of 4 minutes and blanching temperatures of 70, 80 and 90˚C. The oil uptake was found to be 9.21, 7.55 and 6.75 g/100g for the blanching period of 8 minutes and blanching temperatures of 70, 80 and 90˚C. A critical observation shows that an increase in the temperature of blanching causes a decrease in the oil uptake at a constant frying temperature for 2, 4 and 8 minutes of blanching time periods The oil uptake was significantly lower than the control or the unblanched sample fried at 170˚C temperature (oil uptake being 14.78g/100g).

The linear regression equations for 70, 80 and 90˚C blanching are given in equations 3.13, 3.14 and 3.15.

Y=-1.175X+13.117 ….Eqn.(3.13)
Y=-1.84X+13.48 ….Eqn.(3.14)
Y=-1.23X+10.297 ….Eqn.(3.15)

The graphical representation is shown in figure 3.5

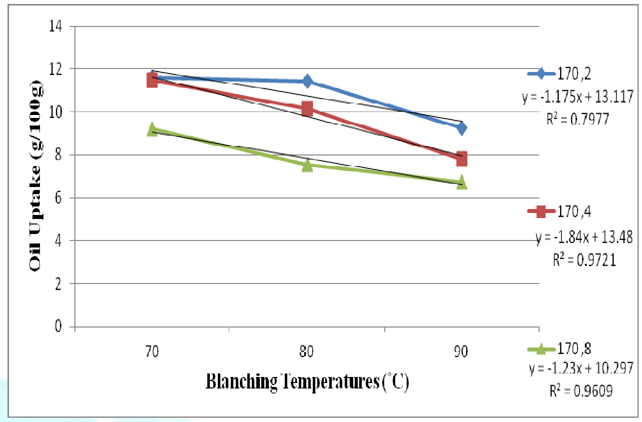

Figure 3.5 Effect of blanching temperatures for samples fried at 170˚C for 2, 4 and 8 minutes of blanching.

3.1.6 Effect of blanching temperatures on the oil uptake of chips fried at 180˚C.

The oil uptake was found to be 11.65, 11.58 and 10.62 g/100g for a constant blanching period of 2 minutes and blanching temperatures of 70, 80 and 90˚C. The oil uptake was found to be 11.61, 11.06 and 8.31 g/100g for the constant blanching period of 4 minutes and blanching temperatures of 70, 80 and 90˚C. The oil uptake was found to be 10.75, 8.96 and 6.05 g/100g for the blanching period of 8 minutes and blanching temperatures of 70, 80 and 90˚C. A critical observation shows that an increase in the temperature of blanching causes a decrease in the oil uptake at a constant frying temperature of 180˚C for 2, 4 and 8 minutes of blanching periods. The oil uptake was significantly lower than the control or the unblanched samples fried at 180˚C temperature (oil uptake being 15.48g/100g).

The linear regression equations for 70, 80 and 90˚C blanching are given in equations 3.16, 3.17 and 3.18.

Y=-0.515X+12.313 ….Eqn.3.16
Y=-1.65X+13.627 ….Eqn.3.17
Y=-2.35X+13.287 ….Eqn.3.18

The graphical representation is shown in figure 3.6.

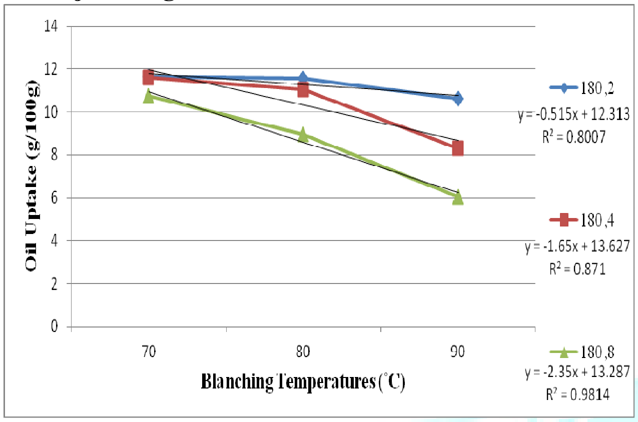

Figure 3.6 Effect of blanching temperatures for samples fried at 180˚C for 2, 4 and 8 minutes of blanching.

3.1.7 Effect of blanching time on the oil uptake of chips fried at 160˚C.

The oil uptake was found to be 10.53, 9.82 and 7.58 g/100g for a constant blanching temperature of 70˚C and blanching periods of 2,4 and 8 minutes. The oil uptake was found to be 10.04, 9.7 and 5.95 g/100g for the constant blanching temperature of 80˚C and blanching periods of 2,4 and 8 minutes. The oil uptake was found to be 7.75, 7.72 and 7.65 g/100g for the blanching temperature of 90˚C and blanching periods of 2,4 and 8 minutes. A critical observation shows that an increase in the period of blanching causes a decrease in the oil uptake at a constant frying temperature of 160˚C for 2, 4 and 8 minutes of blanching periods at each of the three blanching temperatures of 70, 80 and 90˚C. The oil uptake was significantly lower than the control or the unblanched samples fried at 160˚C (oil uptake being 13.95g/100g).

The linear regression equations for 2, 4 and 8 mins blanching period are given in equations 3.19, 3.20 and 3.21.

Y=-1.475X+12.26 ….Eqn.3.19

Y=-2.045X+12.653 ….Eqn.3.20

Y=-0.05X+7.8067 ….Eqn.3.21

The graphical representation is shown in figure 3.7

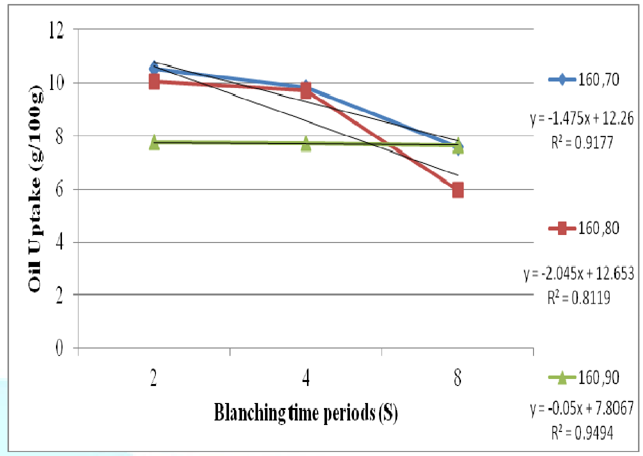

Figure 3.7 Effect of blanching time periods for samples blanched at 60, 70 and 80˚C and fried at 160˚C.

3.1.8 Effect of blanching time on the oil uptake of chips fried at 170˚C.

The oil uptake was found to be 11.6, 11.46 and 9.21 g/100g for a constant blanching temperature of 70˚C and blanching periods of 2,4 and 8 minutes. The oil uptake was found to be 11.45, 10.16 and 7.55 g/100g for the constant blanching temperature of 80˚C and blanching periods of 2,4 and 8 minutes. The oil uptake was found to be 9.25, 7.78 and 6.75 g/100g for the blanching temperature of 90˚C and blanching periods of 2,4 and 8 minutes. A critical observation shows that an increase in the period of blanching causes a decrease in the oil uptake at a constant frying temperature of 170˚C for 2, 4 and 8 minutes of blanching periods at each of the three blanching temperatures of 70, 80 and 90˚C. The oil uptake was significantly lower than the control or the unblanched samples fried at 170˚C (oil uptake being 14.78g/100g).

The linear regression equations for 2, 4 and 8 mins blanching period are given in equations 3.22, 3.23 and 3.24.

Y=-1.195X+13.147 ….Eqn.3.22

Y=-1.95X+13.62 .....Eqn.3.23

Y=-1.25X+10.427 ….Eqn.3.24

The graphical representation is shown in figure 3.8

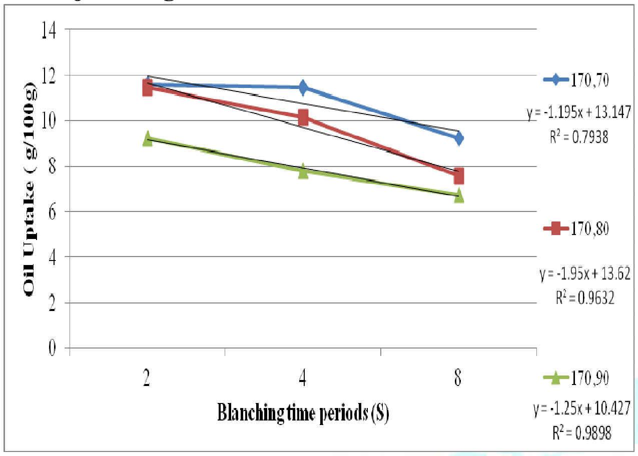

Figure 3.8 Effect of blanching time periods for samples blanched at 60, 70 and 80˚C and fried at 170˚C.

3.1.9 Effect of blanching time on the oil uptake of chips fried at 180˚C.

The oil uptake was found to be 11.65, 11.61 and 10.75 g/100g for a constant blanching temperature of 70˚C and blanching periods of 2,4 and 8 minutes. The oil uptake was found to be 11.58, 11.06 and 8.96 g/100g for the constant blanching temperature of 80˚C and blanching periods of 2,4 and 8 minutes. The oil uptake was found to be 10.62, 8.31 and 6.05 g/100g for the blanching temperature of 90˚C and blanching periods of 2,4 and 8 minutes. A critical observation shows that an increase in the period of blanching causes a decrease in the oil uptake at a constant frying temperature of 180˚C for 2, 4 and 8 minutes of blanching periods at each of the three blanching temperatures of 70, 80 and 90˚C. The oil uptake was significantly lower than the control or the unblanched samples fried at 180˚C (15.48g/100g).
The linear regression equations for 2, 4 and 8 mins blanching period are given in equations 3.25, 3.26 and 3.27.

$Y=-0.45X+12.237$ ….Eqn.3.25

$Y=-1.31X+13.153$ ….Eqn.3.26

$Y=-2.285X+12.897$ ….Eqn.3.27

The graphical representation is shown in figure 3.9.

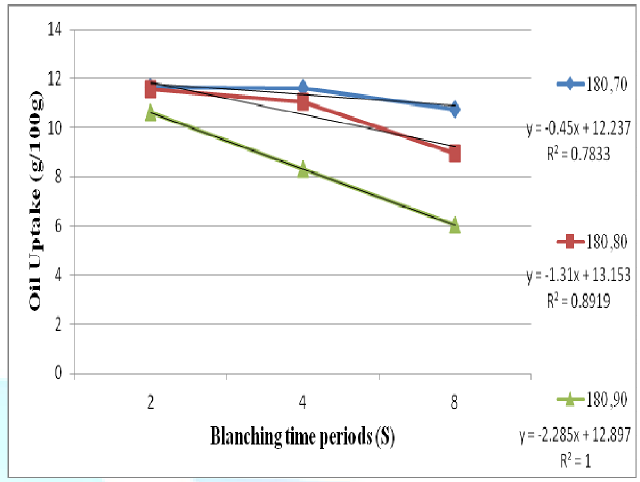

Figure 3.9 Effect of blanching time periods for samples blanched at 70, 80 and 90˚C and fried at 180˚C.

3.2 Effect on the Texture

The textural property of hardness was estimated at various treatment combinations.

3.2.1 Effect of frying oil temperature on the texture of chips blanched at 70˚C

The hardness value was found to be 0.363, 0.362 and 0.351 kg for 2 minutes of blanching followed by frying at 160,170 and 180˚C. The hardness value was found to be 0.365, 0.364 and 0.357 kg when blanched for 4 minutes followed by frying in oil at temperatures of 160,170 and 180˚C. For 8 minutes of blanching at frying oil temperatures of 160, 170 and 180˚C the hardness value was found to be 0.374, 0.370 and 0.365. A critical observation shows that the hardness decreases due to the increase in temperature. The values of all the samples were greater than the control or unblanched samples in the present study. (Control values being 0.339, 0.329 and 0.308).
The graphical representation is given in figure 3.10.

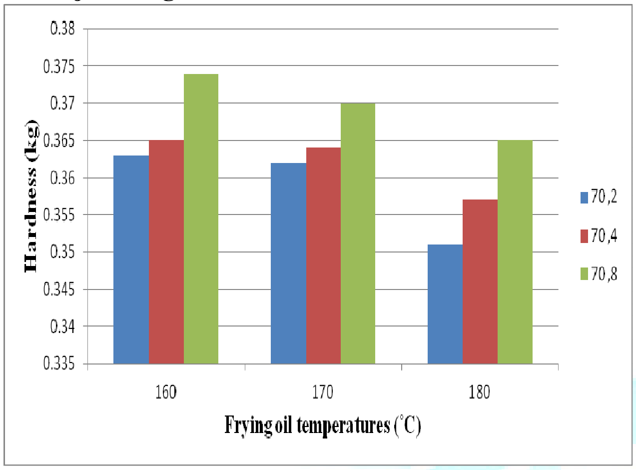

Figure 3.10 Effect of frying temperatures on the texture for samples blanched at 70˚C for 2, 4 and 8 minutes.

3.2.2 Effect of frying oil temperature on the texture of chips blanched at 80˚C

The hardness value was found to be 0.422, 0.413 and 0.391 kg for 2 minutes of blanching followed by frying at 160,170 and 180˚C. The hardness value was found to be 0.443, 0.431 and 0.412 kg when blanched for 4 minutes followed by frying in oil at temperatures of 160,170 and 180˚C.For 8 minutes of blanching at frying oil temperatures of 160, 170 and 180˚C the hardness value was found to be 0.553, 0.530 and 0.509kg. A critical observation shows that the hardness decreases due to the increase in temperature. The hardness for all the samples was greater than the control or unblanched samples in the present study. (Control values being 0.339, 0.329 and 0.308 at 160, 170 and 180˚C).

The graphical representation is given in figure 3.11.

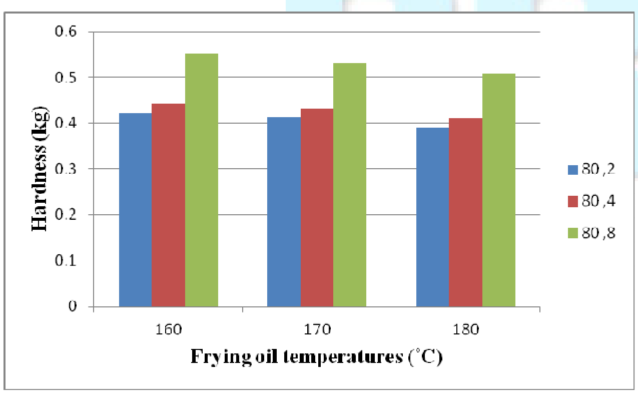

Figure 3.11 Effect of frying temperatures on the texture for samples blanched at 80˚C for 2, 4 and 8 minutes.

3.2.3 Effect of frying oil temperature on the texture of chips blanched at 90˚C

The blanching pretreatment was carried out at a temperature of 90˚C for 2, 4 and 8 minutes. Then frying was carried out at temperatures of 160,170 and 180˚C. The textural property of hardness was analyzed and given in table 4.2. The hardness value was found to be 0.398, 0.384 and 0.372 kg for 2 minutes of blanching followed by frying at 160,170 and 180˚C. The hardness value was found to be 0.371, 0.354 and 0.349 kg when blanched for 4 minutes followed by frying in oil at temperatures of 160,170 and 180˚C.For 8 minutes of blanching at frying oil temperatures of 160, 170 and 180˚C the hardness value was found to be 0.311, 0.291 and 0.286 kg. A critical observation shows that the hardness decreases due to the increase in temperature. Except in the samples blanched at 90˚C for 8 minutes, all the samples have hardness values greater than the control or the unblanched samples (control values being 0.339, 0.329 and 0.311 kg for unblanched samples fried at 160, 170 and 180˚C).

The graphical representation is given in figure 3.12

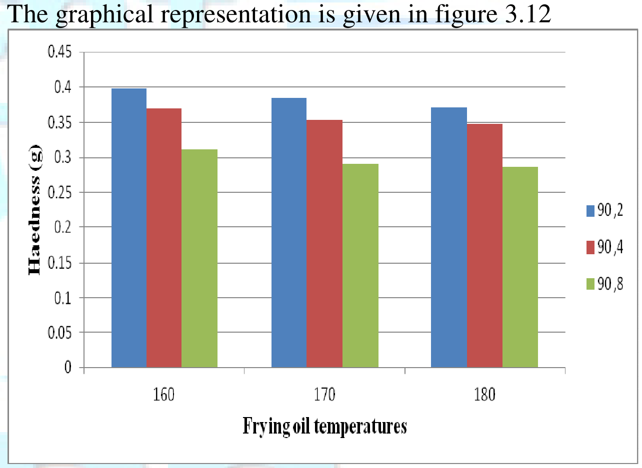

Figure 3.12 Effect of frying temperatures on the texture for samples blanched at 90˚C for 2, 4 and 8 minutes

3.2.4 Effect of blanching temperatures on the texture of chips fried at 160˚C.

The hardness values were found to be 0.363, 0.422 and 0.398 for a constant blanching period of 2 minutes and blanching temperatures of 70, 80 and 90˚C. The hardness values were found to be 0.365, 0.443 and 0.371 for the constant blanching period of 4 minutes and blanching temperatures of 70, 80 and 90˚C. The hardness values were found to be 0.374, 0.553 and 0.311 for the blanching period of 8 minutes and blanching temperatures of 70, 80 and 90˚C. A critical observation shows that an increase in the temperature of blanching causes an increase in the hardness values when the blanching temperature is increased from 70 to 80˚C. As the temperature of blanching is increased up to 90˚C, there was a decrease in the hardness value as compared to 80˚C. For 90˚C and 8 minutes of blanching the hardness values were lower than both 70 and 80˚C temperatures. In comparison to the control sample fried at 160˚C without blanching, only the sample blanched at 90˚C for 8 minutes show a lesser hardness value (hardness value 0.311kg) than the control sample (hardness value 0.339.

The graphical representation is given in fig. (3.13).

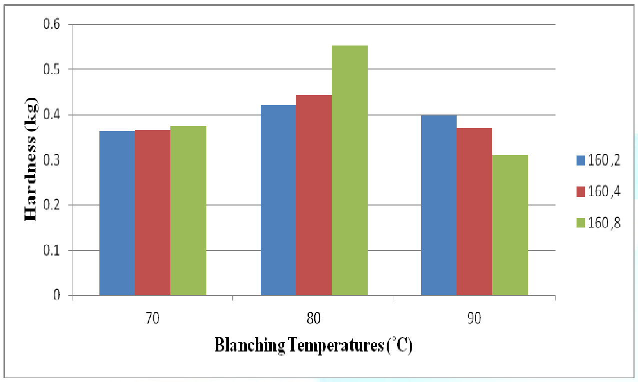

Figure 3.13. Effect of blanching temperatures on the texture for samples fried at 160˚C for 2, 4 and 8 minutes of blanching.

3.2.5 Effect of blanching temperatures on the texture of chips fried at 170˚C.

The hardness values were found to be 0.362, 0.413 and 0.384kg for a constant blanching period of 2 minutes and blanching temperatures of 70, 80 and 90˚C. The hardness values were found to be 0.364, 0.431 and 0.354kg for the constant blanching period of 4 minutes and blanching temperatures of 70, 80 and 90˚C. The hardness values were found to be 0.370, 0.530 and 0.291kg for the blanching period of 8 minutes and blanching temperatures of 70, 80 and 90˚C. A critical observation shows that an increase in the temperature of blanching causes an increase in the hardness values when the blanching temperature is increased from 70 to 80˚C. As the temperature of blanching is increased up to 90˚C, there was a decrease in the hardness value. For 4 and 8 minutes of blanching at 90˚C, the hardness values were lesser than both 70 and 80˚C blanching temperatures. In comparison to the control sample fried at 170˚C without blanching, only the sample blanched at 90˚C for 8 minutes show a lesser hardness value (hardness value 0.291kg) than the control sample (hardness value 0.329kg.)

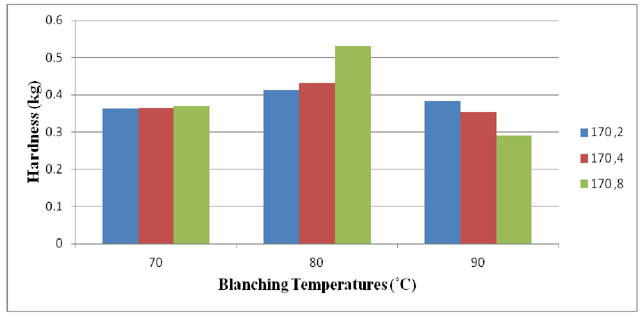

Figure 3.14. Effect of blanching temperatures on the texture for samples fried at 170˚C for 2, 4 and 8 minutes of blanching.

3.2.6 Effect of blanching temperatures on the texture of chips fried at 180˚C.

The hardness values were found to be 0.351, 0.391 and 0.372kg for a constant blanching period of 2 minutes and blanching temperatures of 70, 80 and 90˚C. The hardness values were found to be 0.357, 0.412 and 0.349kg for the constant blanching period of 4 minutes and blanching temperatures of 70, 80 and 90˚C. The hardness values were found to be 0.365, 0.509 and 0.286kg for the blanching period of 8 minutes and blanching temperatures of 70, 80 and 90˚C. A critical observation shows that an increase in the temperature of blanching causes an increase in the hardness values when the blanching temperature is increased from 70 to 80˚C. As the temperature of blanching is increased up to 90˚C, there was a decrease in the hardness value. For 4 and 8 minutes of blanching time periods hardness values were lesser for 90˚C temperatures as compared to both 70 and 80˚C temperatures. In comparison to the control sample fried at 180˚C without blanching, only the sample blanched at 90˚C for 8 minutes show a lesser hardness value (hardness value 0.286kg) than the control sample (hardness value 0.308kg).

The graphical representation is given in fig. (3.15).

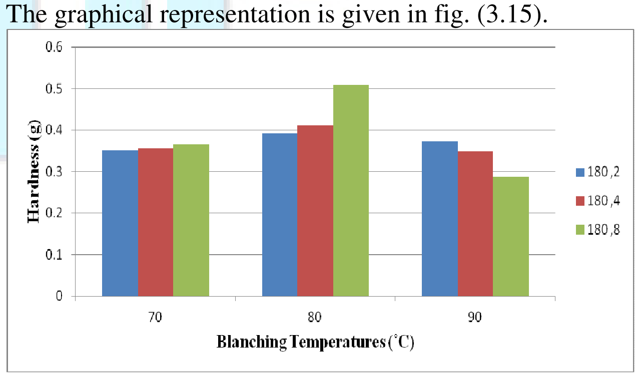

Figure 3.15. Effect of blanching temperatures on the texture for samples fried at 180˚C for 2, 4 and 8 minutes of blanching.

3.2.7 Effect of blanching time on the texture of chips fried at 160˚C.

The hardness values were found to be 0.363, 0.365 and 0.374kg for a constant blanching temperature of 70˚C and blanching periods of 2,4 and 8 minutes. The hardness values were found to be 0.422, 0.443 and 0.553kg for the constant blanching temperature of 80˚C and blanching periods of 2,4 and 8 minutes. The hardness values were found to be 0.398, 0.371 and 0.311kg for the blanching temperature of 90˚C and blanching periods of 2,4 and 8 minutes. A critical observation shows that an increase in the period of blanching causes an increase in the hardness value at a constant frying temperature of 160˚C for 2, 4 and 8 minutes of blanching periods at the blanching temperatures of 70 and 80˚C. However a further increase in the blanching temperature at 90˚C causes a decrease in the hardness values with increasing time periods. The hardness value of all the samples except the one blanched at 90˚C for 8 minutes (hardness value 0.311kg) was greater than the control or the unblanched sample fried at 160˚C (hardness value 0.339kg).

The graphical representation is given in fig.3.16

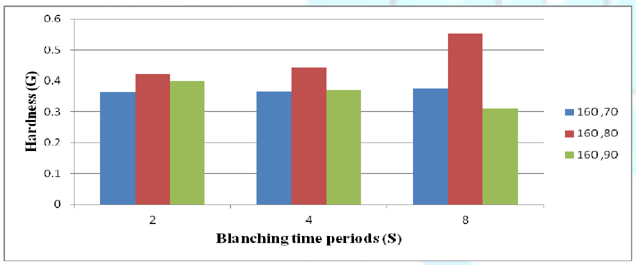

Figure 3.16. Effect of blanching time period on the texture for samples fried at 160˚C at blanching temperatures of 70, 80 and 90˚C.

3.2.8 Effect of blanching time on the texture of chips fried at 170˚C.

The hardness values were found to be 0.362, 0.364 and 0.370kg for a constant blanching temperature of 70˚C and blanching periods of 2,4 and 8 minutes. The hardness values were found to be 0.413, 0.431 and 0.530kg for the constant blanching temperature of 80˚C and blanching periods of 2,4 and 8 minutes. The hardness values were found to be 0.384, 0.354 and 0.291kg for the blanching temperature of 90˚C and blanching periods of 2,4 and 8 minutes. A critical observation shows that an increase in the period of blanching causes an increase in the hardness value at a constant frying temperature of 170˚C for 2, 4 and 8 minutes of blanching periods at the blanching temperatures of 70 and 80˚C. However a further increase in the blanching temperature at 90˚C causes a decrease in the hardness values with increasing time periods. The hardness value for all the samples except the sample blanched at 90˚C for 8 minutes (hardness value 0.291kg) was greater than the control or unblanched samples fried at 170˚C (hardness value 0.329kg).

The graphical representation is given in fig.3.17

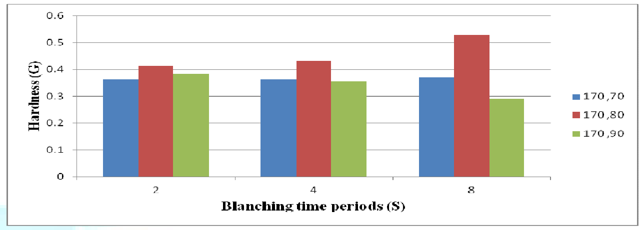

Figure 3.17. Effect of blanching time period on the texture for samples fried at 170˚C at blanching temperatures of 70, 80 and 90˚C.

3.2.9 Effect of blanching time on the texture of chips fried at 180˚C.

The hardness values were found to be 0.351, 0.357 and 0.365kg for a constant blanching temperature of 70˚C and blanching periods of 2,4 and 8 minutes. The hardness values were found to be 0.391, 0.412 and 0.509kg for the constant blanching temperature of 80˚C and blanching periods of 2,4 and 8 minutes. The hardness values were found to be 0.372, 0.349 and 0.286kg for the blanching temperature of 90˚C and blanching periods of 2,4 and 8 minutes. A critical observation shows that an increase in the period of blanching causes an increase in the hardness value at a constant frying temperature of 170˚C for 2, 4 and 8 minutes of blanching periods at the blanching temperatures of 70 and 80˚C. However a further increase in the blanching temperature at 90˚C causes a decrease in the hardness values with increasing time periods of blanching. The hardness value for all the samples except the sample blanched at 90˚C for 8 minutes (hardness value 0.286kg) was greater than the control or unblanched samples fried at 170˚C (hardness value 0.308kg).

The graphical representation is given in fig.3.18

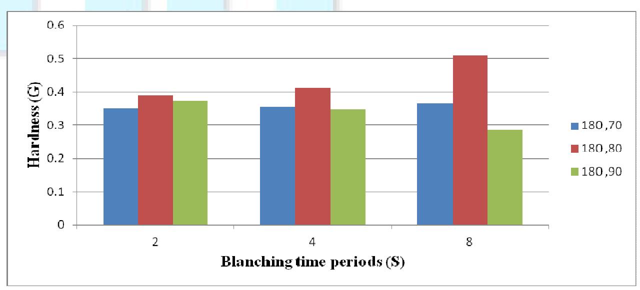

Figure 3.18 Effect of blanching time period on the texture for samples fried at 180˚C at blanching temperatures of 70, 80 and 90˚C.

4. Conclusion

From the study it can be aptly concluded that the processing conditions like blanching and deep fat frying affect the factors like the oil uptake and the textural property of hardness. Increasing the temperature of the frying increased the oil uptake in all cases except the sample involving 90˚C which invoved decreasing oil uptake with increasing frying oil temperatures. Oil uptake for all samples was lesser than the control or the unblanched samples. Thus the blanching pre-treatment enabled a reduction in the oil uptake. Modifications in blanching conditions also resulted in difference in oil uptakes. Similarly textural property of hardness was affected by the processing conditions. Based on the results obtained pre-treatment involving a blanching temperature of 80˚C for 8 minutes and then frying at 160˚C but had the highest hardness value. Hardness value was the least at 90˚C blanching temperature for 8 minutes and frying temperature of 180˚C. Thus blanching at high temperature for high time period and at high temperatures of frying could result in the best textural property.

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AUTHORS' DETAIL

U.KAUSHIK- M.Tech in Food Technology (Food Process Engineering), Department of Food Process Engineering, Vaugh School of Agriculture Engineering, SHIATS University, P.O-Naini, Allahabad, U.P- 211007, India. B.Tech in Food Process Engineering, SRM University, Chennai, India.

R.N. SHUKLA- Assistant Professor, Department of Food Process Engineering, Vaugh School of Agriculture Engineering, SHIATS University, P.O-Naini, Allahabad, U.P-211007, India.

AVANISH KUMAR- Assistant Professor, Department of Food Process Engineering, Vaugh School of Agriculture Engineering, SHIATS University, P.O-Naini, Allahabad, U.P-211007, India.

ATUL ANAND MISHRA- Assistant Professor, Department of Food Process Engineering, Vaugh School of Agriculture Engineering, SHIATS University, P.O-Naini, Allahabad, U.P-211007, India.

W.ELIZABETH- M.Tech in Food Technology (Food Process Engineering), Department of Food Process Engineering, Vaugh School of Agriculture Engineering, SHIATS University, P.O-Naini, Allahabad, U.P- 211007, India. B.Tech in Food Technology, SHIATS.