A STUDY ON SOME DIFFERENT PARAMETERS AFFECTING THE ABRASIVE PEELING MACHINE PERFORMANCE

Tarek FOUDA, Mohamed DARWESH, Mahmoud ELKHODAREY

Tanta university, Faculty of agriculture, Egypt, Phone: +20403455584, Fax: +20403455570, Mobile: +201000350643, Emails: tfouda @yahoo.com, rmdarwish@yahoo.com, mahmoudkotb_675@yahoo.com

Corresponding author: tfouda628@gmail.com

Abstract

Potato varieties (Hermes and Lady Rosetta) harvested from different type of soil (clay and sandy) were vital factors have deep effect in peeling processes addition to potato condition (freshly harvested and stored in a refrigerator for 3 months at a temperature ranges between +7 and +10 Cº and relative humidity ranges between 90% and 95%) were used. .The main objective of this research studies on the factors affecting for abrasive peeling machine performance. The measurements and indicators such as physical properties of potato, the peeling efficiency, peel losses, and emery work time were tested. The results showed that when used stored potato tubers the peeling efficiency decreased by average 16.1 % with using stored potato tubers , the peel losses of potatoes during peeling process decreased by average 16.95 % with using stored potato tubers. Fresh potato tubers showed the decreased in peel efficiency from 96.8 to 52.3 % after 2000 hours from working time, while with using stored potatoes the peel efficiency more decreased from 93 to 54.8 % after 2000 hours of working time .Also fresh potato tubers showed the decreased in peel percent from 2.0 to 0.85 % after 2000 hours from working time, while with using stored potatoes the peel losses of potatoes more decreased from1.85 to 0.77 % after 2000 hours of working time .

Key words: potatoes, fresh, storing, peeling process

INTRODUCTION

Peeling is one of the integral parts of a food processing, and the majority of agricultural crops need to be peeled in order to remove peels at the initial stage of food processing [4] To achieve the ideal peeling conditions using physical and mechanical properties of the product and used a new methods to improvement of current peeling methods [5] The goals of optimum peeling operation are minimizing product losses, minimizing energy and chemical usage and minimizing the environmental pollution. Peeling operation can be grouped under following categories: manual peeling using knife or blade, mechanical peeling using abrasive devices with drums, rollers, knifes or blades and milling cutters, chemical peeling, enzymatic peeling, and thermal peeling [6]. Abrasive peeling was carried out for different types of vegetables with an abrasive peeler. This is simply a drum with a rough inner surface and a motor. After the vegetables are put inside the drum, the inlet is covered, and the drum is

allowed to rotate for a short time. This method is more suitable for root vegetables than fruits, because the latter are usually rather soft. Sweet potato is usually peeled by this method [2]. The mechanical peeler for potato peeling a power operated batch type was developed. The machine contains a drum rotates and removes peel from potatoes by abrasion. The inside peeling drum there are protrusions on the inside surface and Moreover, also a water spraying unit to clean the potatoes and at once peels were removed from the drum. The machine capacity was 100 kg/h with a peeling efficiency and peel losses of 78 % and 6 % respectively [7]. Potato peeling processes face a numerous problems of time consuming and became inefficient during weekly breakdown maintenance. It is very important for food process industry as well as domestic point of view. Mechanization of processing operations will no doubt play a pivotal role in removing the negative attributes of the traditional processing techniques and promote timely

large scale production with desired quality [8].

The performance of the production line and modifying the potato peeler leads to maximize the peeling efficiency by 3.1 %, minimize the mechanical destruction of potato tubers during the peeling process by 32.7 %, minimize the peeling time per one batch by 17.7 % Which led to maximize the productivity of the peeling device by 21.9 % and minimize the amount of needed water consumption for peeling by 17.6 % , also the quality of the final product was improved as the oil content percentage was decreased by 2.4% . [1].

Many factors have effect on the machine peeling efficiency such as the physical characteristics of the potato varieties. Potato source from different locations during different seasons. The objective of this study was to minimize peeling losses and maximize the peeling efficiency addition to evaluate the impact of the durability emery paper and working time

MATERIALS AND METHODS

The experiments were carried out in small factory for making potato chips to investigate the effect of fresh and storing potato tubers at refrigerators on the performance of the abrasive peeling machine of potatoes. Different varieties of potato (hermes and lady rosetta) harvested from soil type (clay and sandy). Two different cases (freshly harvested and stored in a refrigerator for 3 months) Potato treatments were coded as showing in Table 1.

The Peeling machine
In peeling process peels are removed from the skin of the tubers by friction in the presence of water using heat and control patch peeler Model BP

The peeling machine have peeling drum was covered with emery paper to detach peel from potatoes by abrasion. The water spraying unit washes potatoes and simultaneously peel is removed from the drum through the perforation along with the flow of water.

Measuring physical properties of potato tubers [3]
Shape index: Shape index of the measured samples was calculated using the following formula:

$$\text{Shape index} = \frac{L}{\sqrt{D\,T}}$$

Volume of potato tubers: The volume of potato tubers as follows:
$$V\,cal = (\pi / 6)\,(L\,D\,T).$$

where: $V\ cal$ = calculated volume of individual tuber, mm^3.

The geometric mean diameter (Dg): The geometric mean diameter was calculated by using the following equation:
$$Dg = (LDT)^{0.333}$$

Sphericity: Sphericity of the tuber was determined by the following formula:

$$\text{Sphericity} = (Dg/\,L) \times 100$$

where, Dg is the geometric mean diameter of the tuber.

Surface area (A): Surface area was determined by the following formula:
$$A = \pi\,Dg^2$$

Peeling process measurements
The peeling efficiency was determined by using the following formula [7]:

$$\text{Pelling efficiency} = \frac{F1 - F2.}{F1} * 100\%$$

F1 = fraction of peel in raw potatoes and
F2= fraction of peel in peeled potatoes

Actual Peel remove, %: were determined by using the following formula [9] stander skin percent=2.2%

$$\text{Actual Peel remove},\% = \frac{Wr - Wp.}{Wr} * 100,\%$$

where: Wr = weight of washed potato tubers and Wp = weight of peeled potatoes in kg.

Table 1. The coded potato samples were used

Treatments	HCF	HCS	HSF	HSS	LCF	LCS	LSF	LSS
Varieties	Hermes	Hermes	Hermes	Hermes	Lady R.	Lady R	Lady R.	Lady R
Soil type	Clay	Clay	Sandy	Sandy	Clay	Clay	Sandy	Sandy
Conditions	Fresh	Stored	Fresh	Stored	Fresh	Stored	Fresh	Stored

Source: Based on the data from the factory.

Table 2. The properties of potato varieties used in the experiment

Measurement	Treatments							
	HCF	HCS	HSF	HSS	LCF	LCS	LSF	LSS
Length ,mm	94.87	87.47	93.34	91.83	79.47	74.39	83.83	76.56
Width, mm	53.33	51.31	64.00	62.66	62.69	63.98	72.51	69.97
Thickness, mm	44.62	42.95	56.09	49.05	60.98	57.45	62.32	59.89
Dg, mm	60.37	57.09	67.50	63.77	66.13	63.06	72.05	66.87
Shape index	1.98	1.92	1.69	1.85	1.32	1.30	1.26	1.22
Sphericity	63.77	66.424	74.30	74.02	84.46	87.77	86.34	90.64
Surface area	11737.63	10707.35	14695.29	13569.31	14319.91	12924.66	17143.77	14718.04
Volume	124749.92	111072.48	173961.12	162378.91	169391.44	144481.74	225795.62	179125.89

Source: Results based on the data from the factory.

RESULTS AND DISCUSSIONS

Peeling efficiency
The data in Fig (1) shows the effect of treatments on the peeling efficiency. It shows that the peeling efficiency decreased by using the varietyy Hermes stored three months harvested form clay soil, peeling efficiency decreased by 16.1 %, storing causing by change in potato tuber stracure and physical properties. While the maximum peeling efficiency were 93% with HCF and HSF treatments.
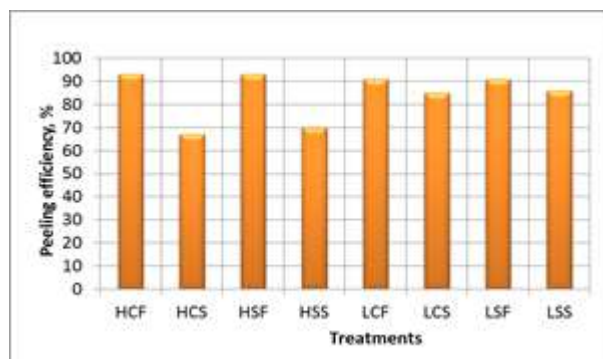

Fig.1. Effect of potato tubers treatments on peeling efficiency**.**
Source: Results based on the data from the factory.

Peel of potato
The data in Fig (2) showing the effect of potato tubers treatments on the peel remove percent, during peeling process potato skin remove by emery paper, the maximum peel percent were 2.08 and 2.03 % with LCF and LSF treatments this results nearest of 2.2% with ideals peel percent, while the minimum peel percent were 1.38 and 1.41 % with HSS and HCS treatments
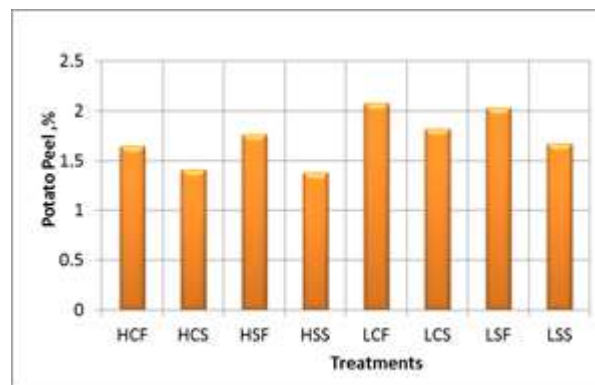

Fig.2. Effect of potato tubers fresh and storing on peel losses
Source: Results based on the data from the factory.

Peeling productivity
The data in Fig 3 and 4 showing the effect of potato tubers treatments on the peeling productivity and actual amount of peel remove during peeling process potato, the maximum peeling productivity reach to 3,600kg/h. and 90kg/h. with LSC treatment

and minimum productivity were 1,800 kg/h. with 45 kg/h. at HSS and HCS.
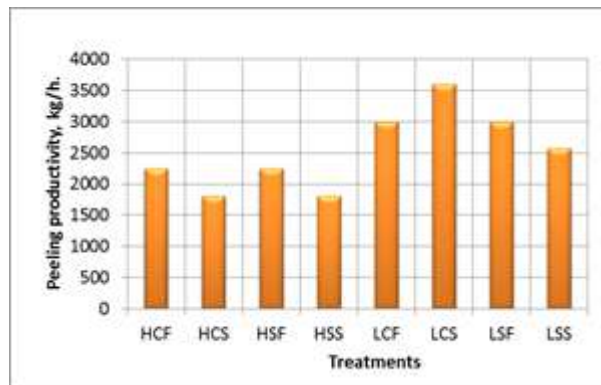

Fig.3. Effect of potato tubers treatments on peeling productivity
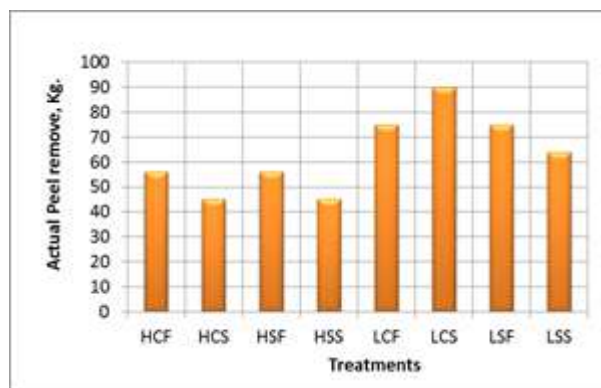Source: Results based on the data from the factory.

Fig.4. Effect of potato tubers on actual remove peel amount
Source: Results based on the data from the factory.

Relationship between peeler work time and peeling efficiency

The results in Figure 5 show the relationship between peeler working time and the peeling efficiency. It shows that the peeling efficiency affected by the work time of the potato peeler before the emery wears out and needed to be changed. At treatment HCF the peeling efficiency decreased from 96.8 to 52.30% during operating time start from 400 to 2,000 h. for peeling machine. The same trend for all treatments but at LSS treatment the scored the minimum results for peeling efficiency. The peeling efficiency decreased at HCF to 64.1% after 1,600 hours with fresh case potatoes harvested from clay soil. But with using stored potatoes the peeling efficiency decreased at HCS to 59.2 % after 1,600 hours.
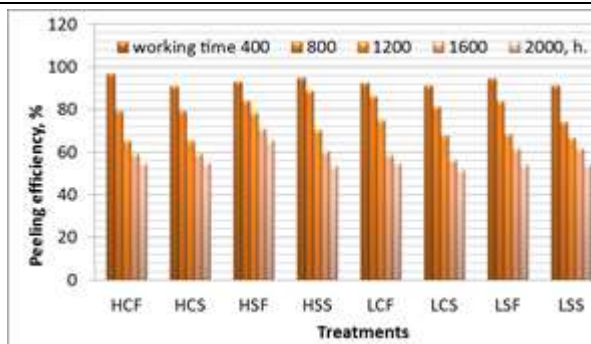

Fig.5. Relationship between emery working time and peeling efficiency
Source: Results based on the data from the factory.

Relationship between peeler working time and peel remove percent

The results in Figure 6 showing the relationship between peeler y working time and the peel remove percent. It shows that The peel remove percent affected by the working time of the potato peeler. At treatment HCF the peeling efficiency decreased from 1.95 to 0.85% during operating time start from 400 to 2,000, h. for peeling machine. The same trend for all treatments but at HSF treatment the scored the minimum results were 0.65% for peeling efficiency. The peel remove decreased at HCF to 0.89 % after 1,600 hours with fresh case potatoes harvested from clay soil. But with using stored potatoes the peel remove decreased at HCS to 0.90 % after 1,600 hours.
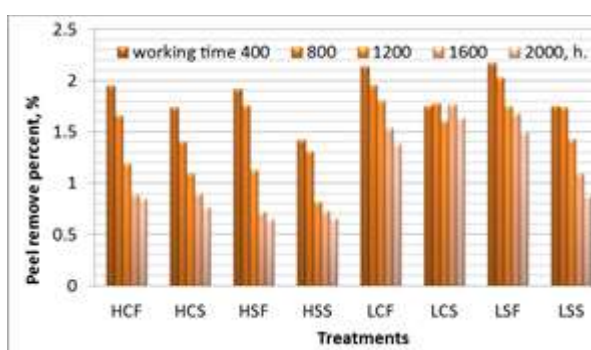

Fig.6. Relationship between peeler working time and peel remove percent
Source: Results based on the data from the factory.

CONCLUSIONS

The experimental clear relation between the potato production conditions such as different varieties of potato (Hermes and Lady Rosetta), which harvested from different soil

type (sand and clay) using freshly and stored in potato production line. The performance of the abrasive peeling machine of potatoes varied by using freshly harvested potato tubers and stored in refrigerators the peeling efficiency decreased by average 16.1 % with using stored potato tubers , the peel losses of potatoes during peeling process decreased by average 16.95 % with using stored potato tubers.

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