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WEARING BEHAVIOURS FOR ABRASIVE PEELING MACHINE UNDER USING FRESH AND STORED POTATOES

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Abstract

The aim of this research to study the effect of using fresh and stored potatoes on the wearing behaviours for abrasive peeling drum, The wearing accrue in inner peeling drum were covered with emery paper to remove peel from potatoes by scratch. The potato using two different cases fresh and stored for three months under the optimum store conditions. The measurement such as wearing rate, wearing resistance, and emery change were tested to study the wearing behaviour. The changes in physical properties of potato tubers accrued because dry matter decreased after storing. The results showed that effect on peeling which varied between 25 to 50 second at constant load of 25 kg, also peeling productivity varied between 1,800 to 3,600 kg/h. the peel amount varied between 45 to 90 kg/h. addition to the minimum time to change emery sheet after 250 h., and 980kg with wearing resistance about 0.011 h/kg while the maximum time to change emery sheet after 1,950 h., and 4,380kg with wearing resistance about 0.022 h/kg.

Key words**:** *potatoes, physical properties, peeling productivity, wearing resistance*

INTRODUCTION

Wear happened by hard particles sliding on a softer solid surface and displaying or detaching material. Different types of interactions are distinguished between the sliding particles and the wearing surface of the solid [2]. In mechanical peeling quantity of peeling is high but quality of peeling is high. Only rotary cutters are flexible one which are most popular among all even on different uneven surfaces. There are different types of mechanical peelers. Based on the mechanism used for peeling, system uses knife or blade, abrasive, rollers, milling cutters and rotary cutters .Developed a diamond cut mesh drum abrasive peeler [1]. The optimum parameters for maximum peeling with minimum loss was obtained at a drum load of 7 kg per batch, operated at a drum speed of 30 rpm for a peeling duration of 15 min, to produce sufficiently peeled. The peeling efficiency and material loss at the optimum conditions were determined as 59.43%, 4.76% respectively. The composition of dried ginger is found to be 0.82%, 2%, 4.6% and 2.5% respectively for moisture content, essential oil, oleoresin, crude fibre content respectively [5].

The peel was removed from the drum through the peripheral clearance of the drum along with the flow of water, spraying unit washed the potatoes. The peeling drum, with protrusion on the inside surface, rotated and detached the peel from the potatoes by abrasion. The machine worked at 45 rpm with a 65 kg/hr capacity [8]. The positive manufacture of a potato peeling is one of the major challenges in potato processing. The peeling machine was designed for peeling and washing of potatoes. The capacity of machine is 400 kg/h with a peeling efficiency and peel losses of 97% and 0.5% respectively which is an improvement over previously fabricated design [10]. The peeling efficiency decreased by 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 from a lot of results showed the performance of the abrasive peeling machine of potatoes varied by using freshly harvested potato tubers and stored in refrigerators [3].

The aims of this work to observing the wearing behaviour for peeling drum.

MATERIALS AND METHODS

The research was permitted to realize the influence of fresh and storing potato were harvested from sandy and clay soil.
A refrigerator work for three months at a 5 C^o temperature and 90% as a relative to stored potato. The treatments of potato were coded as T_1, T_2, T_3, and T_4 using different potato varieties, soil types and potato conditions as shown in Table 1.

Table 1. The potato samples treatments

Measuremei		Varieties		Soil type		Conditions	
		Herms	Lady	Clay	sandy	Fresh	Stored
T_1	HCF	*		*		*	
	HCS	*		*			*
T_2	HSF	*			*	*	
	HSS	*			*		*
T_3	LCF		*	*		*	
	LCS		*	*			*
T_4	LSF		*		*	*	
	LSS		*		*		*

Source: Own results in the laboratory.

The Peeling machine

Using Model BP batch Peelers the peeling machine removed potato skin from tubers by friction with amount of water. Emery paper covered the peeling drum to remove the peel from potatoes by washing. The water spraying unit claning potatoes and the peel was removed. Abrasive sheet kit and disc for potato peeler as shwoing in Fig.1. The first stage in peeler potato pass through coarse abrasive in the peeler rapidly removes peel. The component of emery abrasive from naturally occurring aluminum oxide mixed with other minerals such as silica were used. The sheat hardness ranges between 6-8 on the Mohs scale And 950 VHN Hardness Vickers. The second stage fine abrasive to polishes product surfaces with fewer fines are discharged and product absorbs less oil when fried. The softer abrasive is used in emery boards, emery cloth, and polishing abrasives reducing polishing line depth. Potatoes enter drum, the rotary disc slows motion to prevent damage. During peeling process potato skin remove as shown in Fig.2. For maximum throughput, the hopper is pre-filled before each peeling cycle ends as shwon in Fig.3.

Fig.1. Abrasive sheet kit and disc for potato peeler
Source: own processing based on from Catalogue.

Fig.2. Drum and disc for potato peeler
Source: own processing based on from Catalogue.

Fig. 3. Potato before and after peeling
Source: own processing based on from Catalogue.

Measuring

The changes in physical characteristics of potato tubers [7] such as surface area, shape index, volume, geometric mean diameter and sphericity

Peeling process measurements

Peeling time: duration time to remove potato peel for potato patch (25 kg)

The peeling efficiency using the following formula [9]:

The peeling efficiency =(fraction of peel in raw potatoes - fraction of peel in peeled potatoes)/ fraction of peel in raw potatoes

Peel losses: using the following formula

$$Peellosses = \frac{Wr - Wp.}{Wr} * 100,\%$$

where: Wr : weight of washed potato

Wp: weight of peeled potatoes in kg.

Hardness

The hardness is defined by Vickers hardness number (VHN) were determined from the following equation [4]:

$$VHN = \frac{2p \sin\left(\theta/2\right)}{L^2}$$

P: applied load, kg.
L: average length, mm
θ: diamond angle

Mass losses percent

Mass losses were calculated as follows**:**

Mass losses percent = (mass before using - mass after using)/ mass before using

Wearing rate

Wearing rate were calculated as follows

$$\text{Wearing rate} = \frac{\text{Materials removal from surfaces, g.}}{\text{time h.}}$$

Wearing resistance

Wearing resistance was calculated as inverted wearing rate [6]:

$$\text{Wearing resistance, h/g.} = \frac{1}{\text{Wearing rate , g/h}}$$

RESULTS AND DISCUSSIONS

The results of this study evaluated the effect of changes in physical characteristics of potato tubers resulting from using fresh and stored Haerms and Lady potatoes harvested from clay and sandy soil types on wearing behaviour for abrasive sheet for potatoes peeling.

Effect of potato conditions on changes in physical characteristics of potato tubers

The data in Fig (4) shows the change happened before and after potato stored which harvested from sandy and clay. At T1 the length, width, thickness, diameter, shape index sphericity and volume changed by 7.80, 3.78, 3.74, 5.34, 3.03, 0.5, 8.77 and 10.96 %, respectively. While At T4 the length, width, thickness, diameter, shape index, sphericity and volume changed by 8.67, 3.50, 3.89., 7.18, 3.17, 4.09, 14.14 and 20.66 %., respectively. The amount of changes in physical characteristics of potato tubers accrued because dry matter decreased after storing.

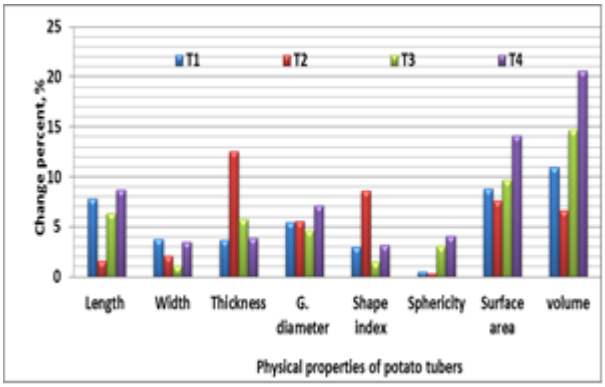

Fig. 4. Effect of potato conditions on physical characteristics of potato tubers changes
Source: Own results in the laboratory.

Peeling time

Fig. 5 shows the peeling duration at constant load of 25 kg, affected by potato samples conditions varied between 25 to 50 second the maximum peeling time at HSC and HSS with 50, S. while the minimum peeling time were LCS at 25 second that refer to varieties of potato and stored conditions.

Productivity and amount of peel

The effect of potato conditions on peeling productivity and peel amount shows, in Fig 6 and 7 the results showed when peeling productivity varied between 1,800 to 3,600 kg/h. the peel amount varied between 45 to 90 kg/h.

Emery change and wearing resistance

Fig. 8, 9 and 10 shows effect of potato conditions on emery change time and per ton, the results showed more factor affecting on emery changes such as potato varieties, freshly harvested and stored in refrigerator addition to potato harvested from soil type. The minimum time to change emery sheet after 250 h., and 980kg at LCS with wearing resistance about 0.011 h/kg while the maximum time to change emery sheet after 1,950 h., and 4,380kg at HSF with wearing resistance about 0.022 h/kg.

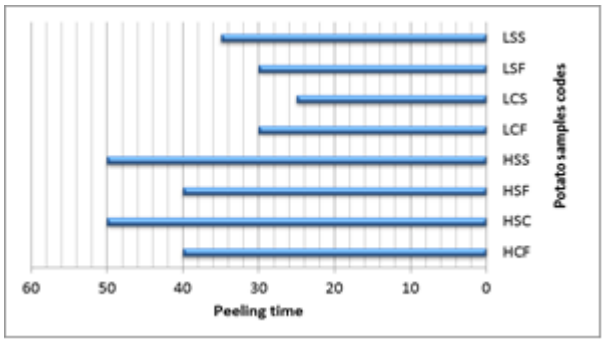

Fig. 5. Effect of potato conditions on peeling time per, second for (25 kg) potato patch
Source: Own results in the laboratory.

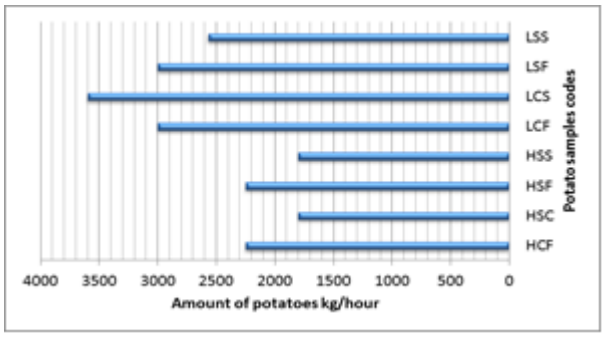

Fig. 6. Effect of potato conditions on peeling productivity
Source: Own results in the laboratory.

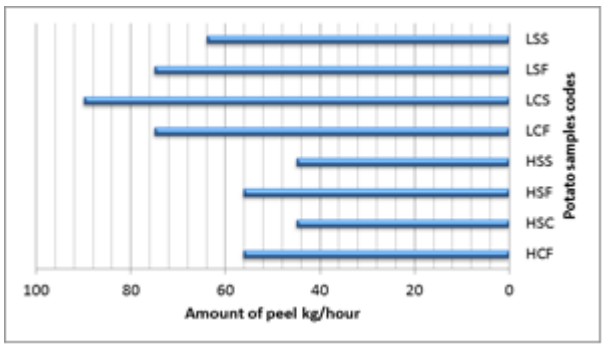

Fig. 7. Effect of potato conditions on amount of peel
Source: Own results in the laboratory.

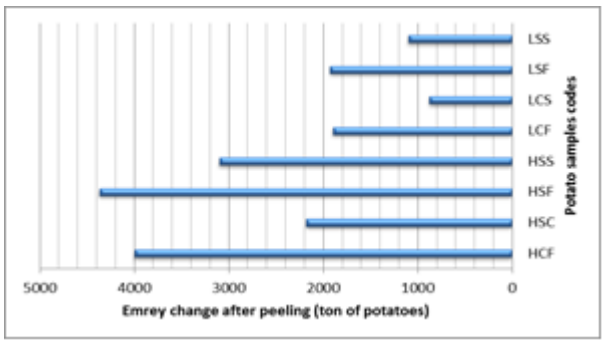

Fig. 8. Effect of potato conditions on emery change per ton
Source: Own calculation.

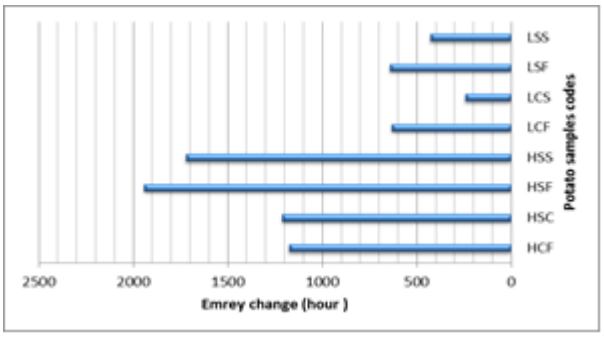

Fig. 9. Effect of potato conditions on emery change time
Source: Own calculation.

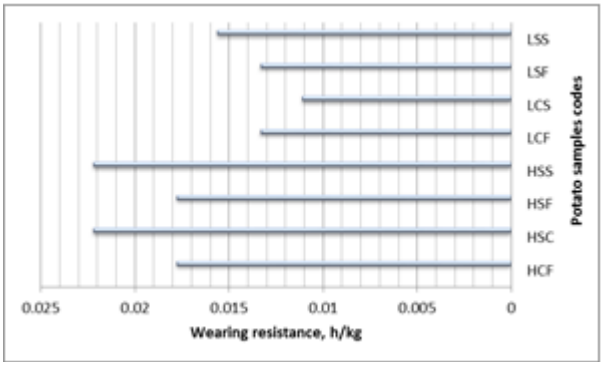

Fig. 10. Effect of potato conditions on wearing resistance
Source: Own results in the laboratory.

CONCLUSIONS

Freshly and stored potato tuber harvested from sandy and clay soil were using in peeling process effect on wearing behaviours for abrasive peeling machine. The amount of changes in physical characteristics of potato tubers accrued after storing. This change effect on peeling time, peeling productivity varied and peel amount which varied between 45 to 90 kg/h. also lead to minimize the time of change emery sheet and decreased wearing resistance

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