CONSIDERATIONS REGARDING THE IMPORTANCE OF THE SORTING OPERATION OF FRUITS AND VEGETABLES

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Keywords: the process of conditioning, pre-sorting, sorting vegetables, fruits, human nutrition

ABSTRACT

For the normal development of daily activity and maintaining health, the body needs a certain amount of energy and complete nutritional factors (proteins, carbohydrates, lipids, vitamins, minerals, water). They are obtained from food, fruits and vegetables occupying a prominent place as a natural source of carbohydrates, alkalizing mineral salts, vitamins and water. Conditioning involves a set of operations aimed at bringing the products to the characteristics provided by standards, specific to a certain direction of capitalization. This article describes the operations included in the conditioning process, the role and importance of presorting and sorting fruits and vegetables, as well as equipment for these operations.

INTRODUCTION

Fruits and vegetables have a complex chemical composition, containing the main groups of organic substances (carbohydrates, sugars, fatty acids, fats, proteins, tanoids, flavors, vitamins, etc.) and mineral substances (with compounds of K, Ca, Mg, Na, Fe, Mn, Al, P, S, Zn, etc.) that are important in people's diets. Because of this complex content, fresh fruits and vegetables have a high nutritional value, which is why they are irreplaceable in the rational alignment of humans.[1]

After harvesting fruits and vegetables, an important place is occupied by the preparation operations for their distribution for fresh consumption. These operations include sorting by geometric dimensions or their individual mass in several fractions, according to required requirements, packaging, packaging, sealing and weighing of products, operations that require a high volume of work. The sorting of fruit consists of separating the mass of fruit from harvest ingeon on dimensionally homogeneous fractions or their weight. The need for sorting results from the fact that dimensional uniformity ensures easy and quick packaging in standard packaging, but has a more attractive commercial aspect, the properties of fruit in the same fraction are more homogeneous, which facilitates storage and storage conditions (because fruits of different sizes have different storage durations). Sorting also allows to separate the fruit into fractions by their food value.[2]

MATERIAL AND METHOD

This tendency to introduce fruit and vegetable sorting machines into agriculture is also manifested in our country and is materialized by the study,

design and manufacture, for internal needs, of some of these machines.

Fruit and vegetable sorting machines must ensure high sorting accuracy and a low degree of mechanical injury for any processed variety Practically a precision is sufficient to ensure in each sorted fraction a content of less than 20% fruit of adjacent fractions, and fruits of a fraction do not differ dimensionally from each other by more than 4-6 mm , to ensure appropriate size uniformity. Today, in European countries, as in our norm, for most fruits and vegetables, as a quality criterion for fruits of the same nature from the sorted fractions, the maximum equatorial diameter is taken.[3]

The requirements imposed on sorting machines arise from the quality requirements imposed on the sorted fractions of fruit and vegetables laid down in the national standards and regulations in force for the domestic market and international regulations for those intended for export.

Worldwide, numerous researches have been carried out on fruit sorting, constituting a permanent concern, sorting leading to the production of homogeneous and more marketable products.[4]

Increased fruit and vegetable production, raw fruit harvesting, the need to preserve them longer, ensuring transport opportunities and the need to reduce labour consumption, in order to give a more attractive commercial aspect, are the main factors that have led to the intensive and widespread introduction in agriculture in the USA, France, Italy, the Netherlands, etc. of fruit and vegetable sorting machines working on different principles.[5]

The precision of sorting is influenced to a large extent by the geometric shape of the fruit. Figure 1 shows various active working organs of machines and installations that perform sorting according to geometric dimensions.

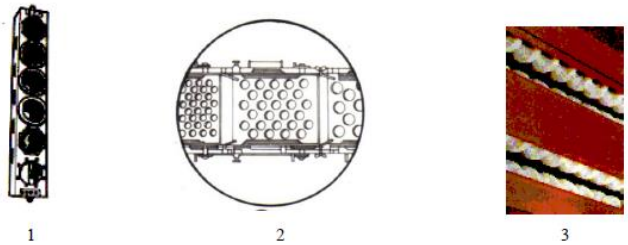

Fig.1 Working organs of sorting machines and installations by geometric dimensions[12]

1 – alveolaconic calibration element with variable aperture; 2 – perforated band calibration element; 3 – helical roll calibration element

Sorting by meal of fruits or vegetables is carried out on the principle of individual weighing of each fruit or vegetable, and their downloading to the fraction corresponding to its mass. The principle of sorting after individual meals allows the separation of fruits or vegetables from any geometric shape, on fractions with a high degree of precision. Active working organs, in this case the elements of the work are made in a multitude of constructive variants, and during the working process they can be fixed or mobile. From the point of view of their placement on the machine and the degree of their use per cycle (between two successive passages through the same point), the machines can be grouped into two categories, namely:

- with linearly arranged weighing elements (horizontal or vertical);
- with circular weighing elements (carousel type).[6]

RESULTS AND DISCUSSIONS

Potato sorting machines, whether used at sorting points or within complex sorting lines, must satisfy certain requirements relating to the quality of the product obtained (depending on its destination) and the technical conditions necessary to carry out the processing operations.

These requirements can be summarised as follows:

The machines must ensure that the potatoes are sorted in three fractions, within established after the meal, in accordance with the rules in force, as follows:

- the large fraction (intended for consumption) comprises tubers with a mass of more than 80 grams;
- medium fraction (intended for sowing) - tubers with a mass of 50 to 80 grams;
- small fraction (potatoes for feeding) – tubers with a mass of 30-50 grams. Tubers with a mass of less than 30 grams form the non-utility fraction.[7]

The permitted tuber content of the other fractions in each of the three fractions considered must not exceed 10 %.

In the process of sorting the machine, no more than 1 % of the total quantity of tubers shall be mechanically injured.

Taking into account the wide variety of varieties and geometric shapes of tubers,

must be provided with the possibility of adjusting the main parameters of the sorting bodies, which ensure the precision required for sorting.

Machines must work on their parameters and performance both at sorting points and in potato warehouses.

Sorting machines at sorting points must be equipped with devices to perform ancillary operations such as: taking potatoes from the means of transport and feeding the machine, separating impurities (earth, stones, vegetable scraps and altered tubers, attacked, etc.) from the mass of tubers, transporting fractions of tubers sorted into containers, bags, crates or means of transport. The machines components of the sorting points must be provided with the possibility of convenient transport from one place to another without dismantling.

The working capacity of machinery at a sorting point shall ensure that at least 15 to 20 tonnes/h are processed in an exchange. In the case of complex sorting and conditioning lines in addition to warehouses, the general working capacity must not be less than 5-10 t/h originally produced.[8]

Machines, which form part of complex sorting-conditioning lines of the potatoes must have related working capacities, and must be provided with independent operation, so that for any variant of the composition of the processing flow ensure the possibility of transmitting tubers from one machine to another, within the line, without the use of manual work. [9]

Tubers intended for processing on complex lines must first be separated from the small fraction.

Complex potato processing lines mustbe installed in special rooms (processing stations) located near potato warehouses. These sections must be equipped with drinking water mouths and sewerage, ventilation and power electrical installation. [10]

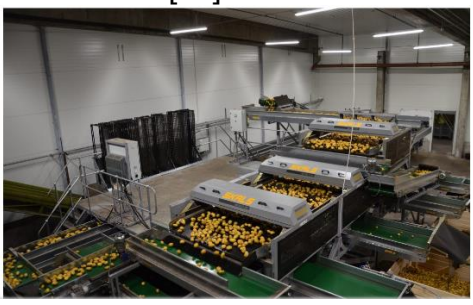

Fig. 2 Sorting machine Skals Dynamic Sde

The company Skals Dynamic SDe from Germany produces sorting machines and this is a new generation of them based on a well-known sorting principle, but developed using state-of-the-art, proven technology shown in figure 2.

The SDe sorter is used for very precise and careful sizing with high capacity and is a Schocksortierer that sorts on sieves.

Compared to other mechanical sorters, shock sorters undoubtedly achieve the most accurate sorting. The sieves ensure a high degree of flexibility with regard to the sorted size steps. SDe sorters are also designed for fast switching between different screen sizes.[11]

Fig. 3 Sorting system in use

SKALS Dynamic SDe sorting systems can be easily integrated into the rest of the product range and allow easy sorting into, for example, sacks or boxes or for further processing with the help of conveyor belts shown in figure 3. The machine is quiet, easy to operate and easy to maintain.

The SDe machine is made up of modules. One module consists of a sieve box and two sieve levels. A module can be used as a pre-sorter or size sorter for three sizes. For 4 or 5 sizes, two modules are used.

Models

These sorting machines SDe are built as standard machines of the type SDe1400 and SDe1800 for three size stages, as well as in modular design, which are assembled for 4 or 5 size stages.

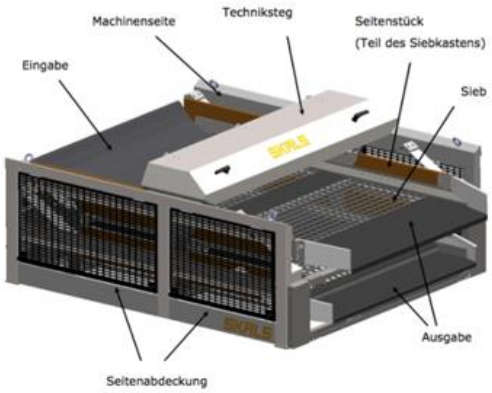

Fig.4. Sorting mechanism

Sorting mechanism

The SDe sorter is based on Elechtrischer Antrieb. The sieve box is a lightweight and rigid construction suspended from 8 composite leaf springs. The sorting movement is provided by an Ascynkron motor via mechanical transmission and a high performance frequency converter shown in figure 4.

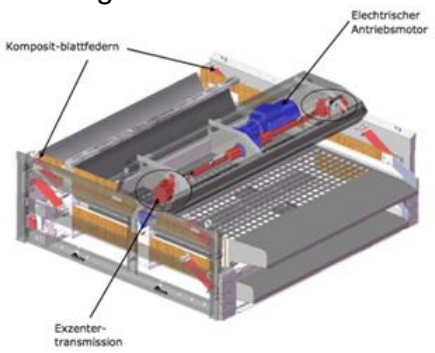

Fig. 5: The red components show the placement of the composite leaf springs and the mechanical transmission. The blue components show drive motor and gearbox.

Sieve clamping device

The screen tensioning device holds the screens in position during operation and allows a quick and easy screen change.

The screen tensioning device is pneumatic and operated from the control panel. Actuator is a simple system of "syringe tubes" that are inflated, keeping the screens in place.

Screen Cleaner

The machine is equipped with a sieve cleaner. The sieve cleaner is driven by an electric motor. The operating interval can be set on the control panel. The sieve cleaner consists of sieve cleaning profiles made of rubber, which ensure that firmly hanging tubers are pushed back into the sieve.[11]

CONCLUSIONS

If until recently these operations were performed mostly manually, with low labor productivity, now they are increasingly mechanized, when the productivity of the work and the quality of

the work increase greatly, sorting is carried out for apples, pears, apricots, peaches, plums, and for vegetables for tomatoes, onions, bell peppers and doughnuts, cucumbers.

One of the most important requirements for fruit and vegetable sorting machines is to cause the lowest possible mechanical damage to the product processed by them.

Therefore, both for the determination of the criteria for sorting by fractions and for the determination of technical measures and solutions for the reduction of mechanical injuries of fruit and vegetables during their processing, it is necessary to know their main physical and mechanical properties which intervene in these operations and the factors influencing these properties.

ACKNOWLEDGEMENT

This work was supported by a grant of the Ministry of Education and Research on the Programme 1 – Development of the national research-development system, subprogramme 1.2 – Institutional performance – Projects for financing excellence in RDI, contract no. 16 PFE

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