

THE SCIENTIFIC BASIS OF THE PROCESS OF VEGETABLE JUICE SQUEEZING OUT OF LEAFSTALK BIOMASS

N.I.Proydak, Professor
Department of Agricultural Machine,
The Don State Technical University,
Gagarin Sq., 1, Rostov-on-Don, 344010, Russia

ABSTRACT

The main regularities of the process of strain of the leafstalk biomass of the annual and perennial sown grasses (hard phase) with the simultaneous filtration of the vegetable juice (liquid phase) in the working members of the uninterrupted action (screw press) and the periodic action (briquetting stamp press) were established. The engineering methods of calculation of the basic constructive - technological parameters of the press equipment of the given types were worked out.

Key Word : Leafstalk biomass, Vegetable juice, Wet fractionation, Modelling, Equipment.

INTRODUCTION

The process of the vegetable juice squeezing is main one in the technology of the wet fractionation (mechanical dehydration) of the leafstalk biomass of the green plants "Dolgov and Proydak (1996)". The outstanding feature of the given process is the capability to control the humidity of the squeezed leafstalk biomass - the vegetable press made of plants depending on its further treatment (silage, grass flour and others).

To obtain protein of the fodder purpose (cytoplasmic fraction) and of the fodder purpose (chloroplastic fraction) it is necessary to ensure the maximum separation of the vegetable juice out of the leafstalk biomass "Proydak and Kireeva (1993)"

To design the equipment ensuring the control of the humidity of the vegetable press made of plants in the required range, it is necessary to work out the

mechanic-technological regularities of the process of the leafstalk biomass.

The analysis of a prior information showed the expediency of usage for the squeezing of the vegetable juice of the leafstalk biomass of the sown grasses the equipment of the uninterrupted action - the screw and drum presses and also the equipment of the periodic action - the briqueting stamp press. But thought the drum presses are very effective ones their design is only at the initial stage.

Consequently, the purpose of the present work is the determination of the main regularities of the process of the vegetable juice squeezing in the screw and stamping presses and of the calculation of the equipment of the given types.

MATERIALS AND METHODS

The process of the wet fractionation (mechanical dehydration) is considered as the totality of the three consequent stages, that are characterized by the compressive strain of the leafstalk biomass - the threephase heterogenous system "dry substance-water-gas" until the obtained of the state of the hydromass-twophase system "dry substance-water"; the prolonging compressive strain of the hard skeleton phase of the hydromass with the simultaneous filtration out of it the liquid phase - the green juice; the growing compressive strain of the hard skeleton phase until the given density with stopping the filtration of green juice "Proydak (1994)".

With this the process of compressive strain leafstalk biomass is differed by the following features: the non-linear character of the dependence between the stress and strain; the possibility of the momentary strain on the stage of the receiving the state of hydromass; stress relaxation; elastic-viscous aftereffect; the remanent strain and others.

On the base of the analysis of a prior information, as the approximate mechanical model, Burgers fourlement model with Maxwell and Kelvin-Foygt non-linear subsystems was taken. The analysis of Burgers non-linear model was conducted by the method consisting in the description of the behaviour of the mechanical system (under the effect of the given forces) by means of the establishment of the law of the change of points grid reference with time course. For the representation of the force proportional to displacement, the elastic element - the spring was taken. Force proportional to the first derivative of the displacement on time was designed by the viscous element - the cylinder filled by the viscous liquid, where the piston with the perforated holes was being moved "Proydak (1992)".

RESULTS AND DISCUSSION

The theoretical investigations carried out on the process of vegetable juice squeezing out of leafstalk biomass in the work members of the periodic action - open and close pressing canals of the cylindrical and conical forms of the stamp presses and the work members of the continuous action - work chambers of the conical and cylindrical forms of the screw presses, allow to establish:

- axial pressure distribution and pressure value on the stamp and on the turns of the screw press;
- axial and radial speed of distribution on the second stage of the process;
- mass consumption of the fluid phase (juice) on the second stage through the rear surfaces of the pressing canal and work chamber; full-work on squeezing and efficiency in the stamp presses;
- moment of torsion of the shaft of screw, summing work and power necessary for squeezing in the screw press and others "Proydak (1993)".

On the strength of the results of the theoretical investigations the engineering methods of the calculation of the main constructive-technological parameters of the screw presses "Proydak (1995)" and stamp presses "Dolgov and Proydak (1991)" intended for squeezing the vegetable juice of the leafstalk biomass with ensuring the control of the vegetable press made of plants humidity were worked out.

The first method was used with the design of the screw press of output 10 t/hr on the leafstalk biomass. The given press entered a set of equipment for treatment of the leafstalk biomass of the annual and perennial sown grasses into the fodder (silage, grass flour) and pasty protein supplements with long term of storage in the aerobic conditions "Proydak et al (1995)".

After conducting the long tests at the farms of the Moscow and Rostov regions the given set of equipment was recommended by the state commission to the serial production.

CONCLUSIONS

The results of the long tests of the press equipment worked out on the base of the data of the engineering methods of the calculation corroborated the reliability and possibility to use for the practical purposes.

The further investigations are to be directed on working out the mechanic-technological basis of the process of the vegetable juice squeezing out of the leafstalk biomass in the drum press and the design of the high effective equipment of this type.

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