ON THE POSSIBILITY OF USING PHYSICAL FIELDS FROM ACOUSTIC CAVITATION IN LIQUID ENVIRONMENTS IN THE PROCESSING OF SEEDS BY DRY TECHNOLOGY

О ВОЗМОЖНОСТИ ИСПОЛЬЗОВАНИЯ ФИЗИЧЕСКИХ ПОЛЕЙ ОТ АКУСТИЧЕСКОЙ КАВИТАЦИИ В ЖИДКОСНЫХ СРЕДАХ ПРИ ОБРАБОТКЕ СЕМЯН ПО СУХОЙ ТЕХНОЛОГИИ

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Abstract*: Acoustic cavitation technologies are a highly effective means of processing liquid media, as well as various materials in liquid media. They significantly accelerate known processes in liquids and, in addition, make possible the implementation of previously impossible processes. The phenomenon of cavitation has and another quality - the creation around itself of physical fields (including magnetic fields) with high stresses. This circumstance makes it possible to produce some types of work on "dry" technology, for example, to awaken and process seeds before planting. Placing the seeds from the outside of the vortex cavitator causes the magnetic field to be sparing effect on them. Seat placement inside the workspace predetermines a hard impact, so therefore in a real device through the centers of cavitation they move through the tube-seminal duct. The thickness of the walls determines the degree of influence of the physical fields on them.*
KEYWORDS*: ACOUSTIC CAVITATION, SEEDS, HYDRODYNAMIC CAVITATOR, ACTIVE ZONE, A MAGNETIC FIELD,RESONATOR, PASSIVE ZONE, DRY PROCESSING.*

1. Introduction

At the moment, mankind knows the universe from the device of the universe to phenomena occurring at the level of elementary particles. It is expedient to use the results of the received knowledge in practical application, for example, for the production of food products by organizing processes in agricultural production on the basis of new physical principles of action.

An example of such a concept is the use of acoustic cavitation technology, which involves the acceleration of known technological processes, as well as the creation of new impossible before. However, the process of cavitation involves working with liquid media in which the formation of cavitation caverns takes place and their subsequent collapse. This circumstance significantly reduces the range of use of such technologies, for example, in presowing operations, since the sowing activities themselves are currently carried out under the "dry" option.

2.1. Preconditions and means for resolving the problem

To expand the technological capabilities of the cavitation technologies used, one must know the mechanism of acoustic cavitation flow.

In the course of the acoustical-cavitation process, the following facts should be noted:

- a relatively long phase of cavern growth and its instantaneous collapse (fig.1).

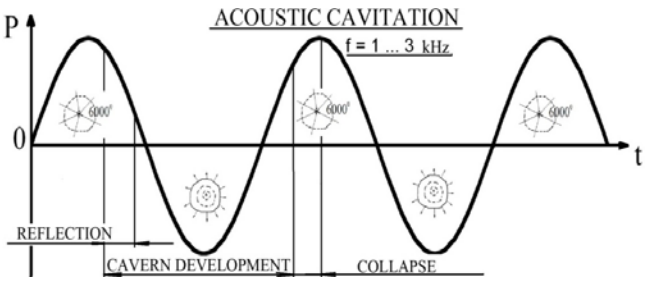

fig.1. *Mechanism of the acoustic cavitation*

- the change in the size of the cavitation cavern occurs from millimeter to nanometer values;

- the elastic energy stored in the formation and expansion of the cavity, is compacted by collapsing, both in space and in time (in the form of an electromagnetic pulse), which causes its ultrahigh density [1];

- such intense and detailed collisions of particles of a liquid presuppose a collision and deformation, both of individual clusters and molecules of their generatrix, which deforms the very structure of the molecules;

- the deformation of initially stable molecules and their formations leads to a redistribution of the strengths of physical fields with the formation of an electromagnetic pulse at each period of the perturbation that has occurred;

- as a result, integrated magnetic and other types of physical fields are created around the zones of the working space with increased cavitation.

We note that the experimental data are nowhere equal to zero. From the mathematical point of view, this means that the field is parallisomo, that is the field lines of force do not touch each other.

A feature of the structure of this magnetic field is that its lines of force are closed mainly to the foci of the flow of cavitation processes:

- a vortex chamber;

- straightening the flow of the tuning fork plate at the exit from the body;

- the antinode of a standing acoustic wave in the middle of the body.

The presence of the established fact makes it possible to carry out operations to awaken and develop seeds by "dry" technology (fig.2), both from the external volumes of the cavitator, and in the internal (in the axial tube).

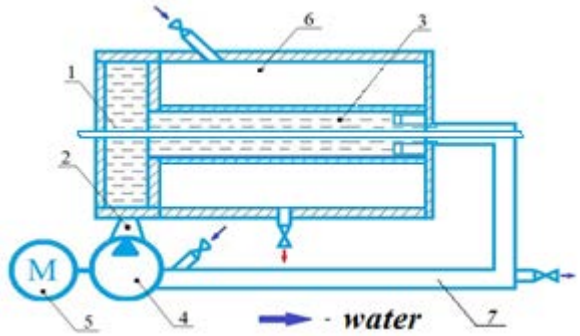

***fig.2**. Principal scheme of vortex cavitator with water casing : 1- cyclone; 2 – nozzle; 3 – resonator; 4 – pump; 5 – driving engine; 6 – casing; 7 - return line*

3. *Solution of the problem*

At the Faculty of Engineering of the Nizhny Novgorod State Agricultural Academy, experimental studies were conducted on "dry" seed treatment, both from the outside and from the inside.

The results of processing sunflower seeds from the outside of the vortex cavitator provided an increase in germination from 82% to 96% due to heating factors, the action of physical fields, mechanical vibrations (fig.3)

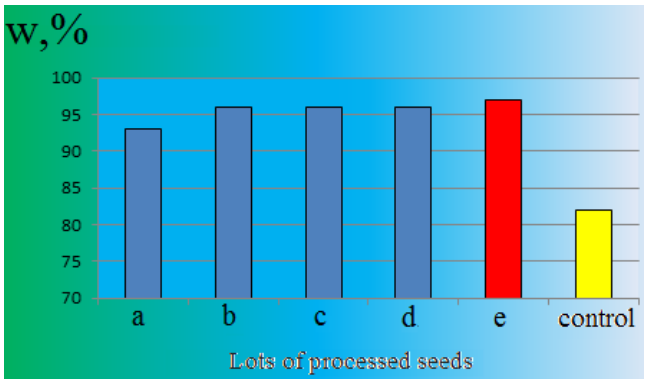

***fig.3.** Results of "dry" treatment on the surface of the resonator*

In this case, the best results correspond to the middle part of the body, where the antinode of the standing wave is located, as well as its end, where there is another local focus - the plates of the tuning fork tunnels.

In addition to the location along the length of the body, the efficiency of presowing treatment is also influenced by the removal of seeds from the body in the radial direction (fig.4).

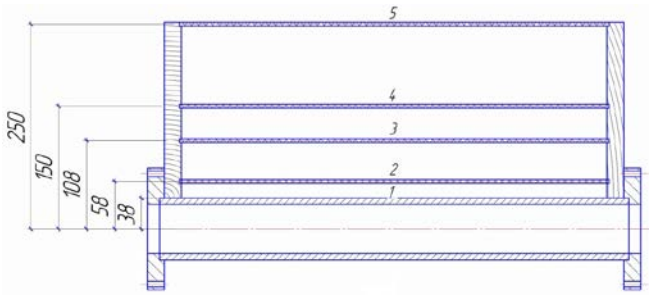

***fig.4**. Scheme of the experiment.*

The level of intensity of the generated physical fields for points 1 and 2 at an exposure value τ = 120 min is excessive (fig.5),

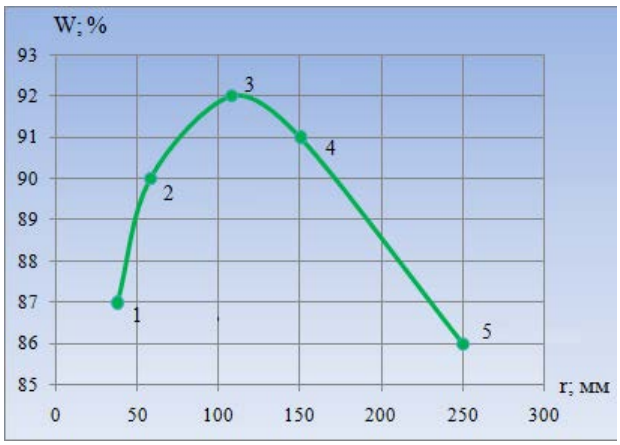

***fig.5.** Regularity of the effect of removal of processed seeds on their germination.*

for points 4 and 5, the amount of impact at the considered distances and field strength is inadequate. The best results under the conditions under consideration show the removal of R = 108 mm.

Seeding with cavitation inside the body of the vortex cavitator acquires its specificity due to the approach of the seeds directly to the cavity, which necessitates a reduction of exposure from hundreds of minutes (with external processing) to several seconds. This circumstance makes it possible to delegate the acoustical-cavitation type of processing from the laboratory type to the production one.

Experimental studies on acoustic cavitation processing inside the working space were carried out on a special design of the vortex cavitator, the scheme of which is shown in fig.6

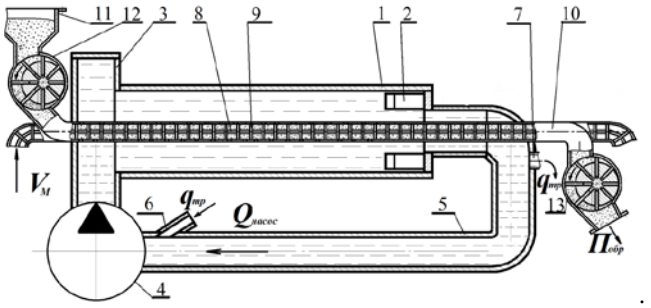

fig.6. *Scheme of the vortex cavitator for seed treatment in the core.*

A feature of this design is the presence of a central transport channel, equipped with a conveyor. The speed of transportation determines the exposure time, and presence - the absence of perforation in the transport channel determines the "wet - dry" type of treatment. The conveying channel is made interchangeable (fig.7.)

fig.7. *General view of the experimental setup*

In the installation in question, the transporting organ is made in the form of a shell with seeds stretched within the channel.

The results of experimental studies showed:

- the best indicators for germination and the rate of subsequent development of plants correspond to the location of seeds in the zones of greatest intensity of acoustic cavitation:

- - a vortex chamber;

- - antinode of a standing acoustic wave in the middle part of the body;

- - cantilever plates (tuning forks) of the straightening device (fig.8);

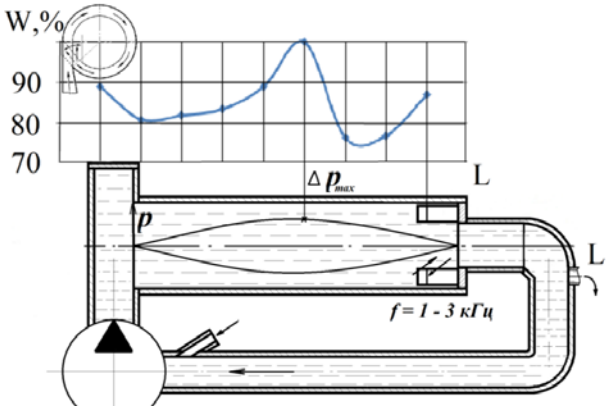

fig.8*. Zones of the greatest efficiency of a vortex cavitator in the presowing treatment of cucumber seeds.*

- in each of these zones, when the duration of exposure τ is increased, the cycling of germination changes takes place, due to the immune system's response functions to the size of the awakening effect (fig.9);

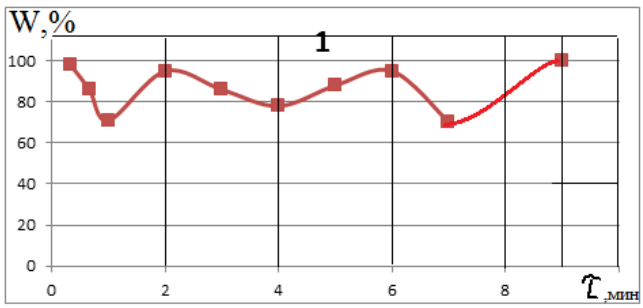

fig.9. *The cyclic regularity of the change in germination from the exposure time τ for the first point of location of the samples.*

- when using this type of processing, it is possible to reduce the exposure time to several seconds, which allows to increase the productivity of the installation to the required level;

- the degree of influence of the cavitation zones on the planting material can be controlled by the thickness of the walls of the transport channel.

1. Conclusions

1. The vortex cavitator is a highly effective device for presowing seed treatment.
2. Along with hydrodynamic processes, cavitation is accompanied by the creation of physical fields around its foci:
- a vortex chamber;
- antinodes in the middle part of the body;
- cantilever plates (tuning forks) on the output from the case.
3. The magnetic field permeates the metal casing and can affect the seeds located at a distance from the casing.
4. The amount of seed removal from the body in the radial direction is the optimum value:
- with a small removal of seeds, excessive effect is obtained;
- at a greater distance - insufficient.
5. Inside the hull, the impact on the seeds is even more intense - a few seconds of treatment is sufficient to wake the seeds.
6. It is possible to control the intensity of the treatment by changing the thickness of the walls of the transport channel (the seed duct).

5. Literature

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