Chapter 1

The Application of Electrophysical Effects in the Processing of Agricultural Materials

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ABSTRACT

Crop production is largely associated with a number of external factors that affect productivity, quality, and cost of production. A significant part of the cost (20-40%) occurs on post-harvest processing, storage, and preparation for feeding. These processes include drying, decontamination, steaming, micronisation, etc. The chapter describes the electrotechnology impacts and their use in processes of grain processing. The chapter deals with the classification of electrophysical methods of influence, correlated with the processes in which they can be applied. It describes the required levels of exposure and the resulting values of productivity, intensity, and other parameters, qualitatively describing the specific processes. The factors which can positively affect grain production include the use of ozone, ions, infrared, and microwave fields.

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INTRODUCTION

The loss of grain crop during cultivation, harvesting, post-harvest processing and storage is in the range of 5-40% according to various estimates. From our point of view, the greatest interesting are the losses during post-harvest processing and storage. They form about 80% in the structure of these losses. These losses are mainly related to irregularities in the processing technology of storage and post-harvesting. However, in cases of high average yields and the associated reduction in the cost of crop production, it is cheaper for producers to leave part of the crop that requires drying. This happens because of the high cost of post-harvest heat treatment of grain and drying in particular.

BACKGROUND

The average annual loss of grain is about 10% of total production according to the Food and Agriculture Organization (FAO). At the same time, for some less technologically advanced countries this indicator reaches 30-50%. In addition to the loss of the crop volume in case of irregularities in the technological processes of processing and storage, there is a decrease in the quality, sowing and nutrition indicators of grain. The highest level of losses is typical for farms with a low level of technical base and outdated equipment used for processing and storage of grain. Technically, there can be reached the level of losses of 1-2%, which is typical for countries with a high level of technological advance (Germany, Canada, USA).

Losses of grain mass could be divided into mechanical and biological. Some types of losses cannot be avoided, for example, natural loss of grain mass, loss of dry matter due to transpiration. Others are the result of irregularities in post-harvest processing and storage. It is necessary to fight against such losses both organizationally and technologically. The values of natural losses of grain and grain products during storage and transportation are determined by the standard method. Also, do not forget about the pests of grain stocks, whose life activity increases in the overall level of loss of grain mass.

In case of irregularities of storage technology there appears losses of grain due to increased breathing, self-heating, as well as the growth of microorganisms. In cases of increase in humidity or temperature of grain, and especially at joint action of these factors there is a danger of crop damage. This happens due to the sharp intensification of grain respiration at humidity above the standard, accompanied by a loss of dry matter. Air humidity levels for different crops are slightly different and humidity levels that characterize the intensification of breathing and reduce in the safe storage time are different. Thus, millet seeds with a moisture content of 14-15% breathe 2-4 times more intensively than with a moisture content of 13%. Raw wheat grain with a moisture content of more than 17% breathes 20-30 times more intense than dry (14%). In wheat, triticale, rye and barley, the maximum respiration rate corresponds to a temperature of 50...60 °C (almost regardless of humidity). However, with increasing grain moisture from 14 to 22%, the intensity of respiration increases by almost 20 times. If the moisture content of rye grain increases from 15 to 20%, the intensity of its breathing increases 35 times.
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