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THE APPLICATION OF ELECTROSTATICS TO SEED SEPARATIONS

T. Wayne Still ^{1/}

The machines discussed up to now utilize the differences in physical properties of the seed, such as weight, shape, size, length, width, surface texture, and color to make a separation.

Unfortunately, the components of certain seed mixtures do not differ sufficiently in physical properties of characteristics to permit separation by conventional methods or equipment. Application of the electrostatic principle of separation offers solutions to such problems.

Electrostatic separators are not a new principle of separation but its application to the separation of seeds has not received much attention until recent years. The electrostatic separator, like the gravity, the magnetic and other separators, was designed for use in the mining industry and has found its way into the seed industry, with certain modifications of course.

Since electrical properties and not physical characteristics are the basis for separation in an electrostatic separator, the adaptation of this equipment for seed cleaning may be somewhat more complicated than it appears by casual observation. Those of you that have experience with this machine will readily agree with this, I'm sure.

Electrostatic separation is the process of separating one material from another with charged electrodes. The materials or seed to be separated must be oppositely charged, or must exhibit different intensities of the same charge. The chief value of electrostatic separation lies in the area of separating seeds of the same size, and weight, which cannot be separated by common or conventional means.

An electrostatic separator consists of a feeding mechanism, a separating area energized by a positively or negatively charged electrode, and divided compartments for receiving the separated seed.

Separation is accomplished on the basis of the law that like charges repel and unlike charges attract. Separations may also be possible where unlike particles acquire different strengths of charge. When a mixture of seed differing in polarity or strength of charge are passed through the separating area, oppositely charged seed are attracted toward or repelled from the electrode in proportion to the strength of the charge.

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The principle of electrostatic separation is employed by use of two methods or a combination of the two methods, which utilize different adjustments and electrodes. One is the non-discharging field or low intensity method and the other is the discharging field or high intensity method.

In the low intensity method separation of the seeds is dependent chiefly upon the polarity of the charge on the individual seeds. When seeds are passed through the electrostatic field, particles charged oppositely from the electrode are attracted toward the electrode, lifted away from the normal pattern of fall and separated from the remainder of the seed with the adjustable splitters.

In the high intensity method separation of the seeds is dependent upon the conductivity of the individual seeds. Seeds passing through the discharging field are pinned to the grounded rotor. The length of time seeds remain pinned to the rotor depends upon the duration of the charge on the surface of the seed. The charge is rapidly dissipated from good conductors to the grounded roll, allowing the seed to fall freely while non-conductors retain the charge much longer, and are brushed away from the rotor and into a different compartment. Poor conductors react intermediately to the other two classes. Polarity is of little importance as the charge assumed is opposite that of the rotor.

Successful application of the electrostatic separator to the separation of seeds is dependent upon several factors.

1. Moisture content of the seed - usually lower than that required for safe storage of the seed.
2. Relative humidity of the air - usually lower than prevailing humidities in this part of the country.
3. Temperature of the air - not too important as long as it is constant. Temperatures that fluctuate quickly affect the effectiveness of the separation.
4. Temperature of the seed - slightly heating the seed immediately prior to entering the separating area may render a separation not possible without heating.
5. Mechanical factors - adjustments of the machine itself, such as voltage, polarity of the charge, position of the electrode, speed of the grounded rotor, and others, all affect the separation.

As pointed out earlier, the most practical application of the electrostatic separator is in separating seeds of the same physical characteristics and which cannot be separated by conventional means. Several workers have reported that the separations listed below have been successfully accomplished by use of the electrostatic separator. The list is not all inclusive.

Hulled Johnsongrass from hulled sesame

Rat excreta from grain

Wild onions from wheat and rye

Pigweed from white clover

Curly dock from red clover

Preliminary work at the Seed Technology Laboratory indicates that it may be possible to separate cocklebur from machine and flame delinted cottonseed. More work on this is forthcoming.