



SEED MOVEMENT DURING SIZE FRACTIONATION ON A VIBRATING SCREEN CALIBRATOR

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ABSTRACT

Grainy material displacement on a vibratory screen mesh was studied. The main goal of the study was optimal selection of drive parameters for obtaining spiral movement of raw material from the center of the screen to the outlet on its rim. Simultaneously, intensity of the process and level of screen coverage with raw material were observed.

Keywords: Vibrating screen calibrators, sieved material displacement

INTRODUCTION

Both field and laboratory investigations of seeds separated in size fractions have shown that the germination energy and yield are dependent on the seed size within the same seed lot [1,2].

Fractionation of seeds according to their size is carried out in a variety of devices called calibrating machines. These are most commonly screen sievers of various designs [3-5]. For continuously working calibrators the quality of separation increases with the average distance traveled by a seed on the screen before being collected. For small seed lots (vegetable or flower seeds) it is necessary to assure a sufficiently long average traveling distance in spite of small dimensions of the device [6,7]. Another design requirement to be met is elimination of any tossing of the seeds off the screen. This demand results from the necessity to classify usually oblong seeds according to their largest dimension [8,9].

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EXPERIMENTAL

An example of a screen calibrator where these two designing demands for precise calibration of seeds are successfully addressed is shown in Fig. 1. [6] This design has been awarded with a Gold Medal at BRUSSELS EUREKA 2001, 50th World Exhibition of Innovation, Research and New Technology. Brussels (Belgium), 13-19 November 2001.

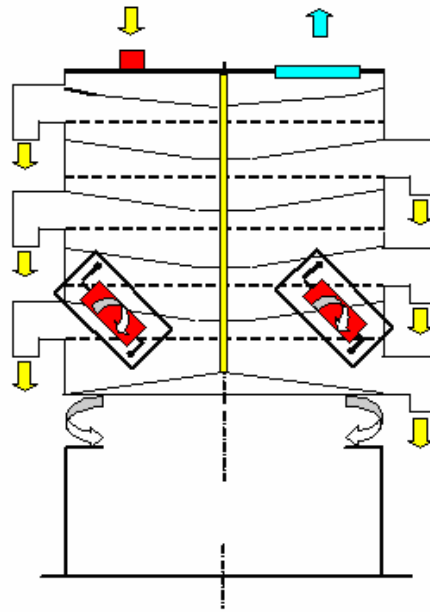


Fig. 1. Multideck vibrational screen.

A column of a certain number of screen segments is mounted on the metal base of the calibrator, Fig. 2. Screens (600 mm in diameter) with cleaning devices are placed in between the segments. The column is supported on 12 coil springs.

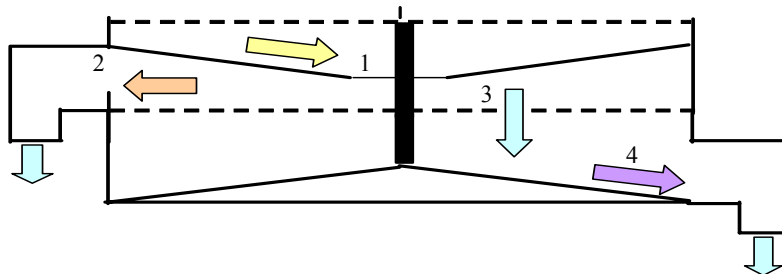


Fig. 2. Schematic drawing of a single calibrator segment.

Arrows 1-4 indicate the seed movements studied. Chutes lead the seeds from the screens to stub pipes and further to fraction collectors. The bottom segment with a conical seed directing plate below its screen rests on a base. The column is covered with a flat bonnet furnished with an inlet stub pipe for seed delivery and an outlet stub pipe for dust removal. The calibrator is driven by two vibrators mounted on one of the segments opposite to each other and tilted at the same, although, freely chosen angle. This kind of drive enables substantial elimination of vertical vibrations of the screens.

The calibrator's vibrations were measured as light traces from a laser that was fixed on the calibrator. The light spot was projected on a screen at a distance of 6 m from the laser.

RESULTS AND DISCUSSION

The vertical and plane components of the vibrations as a function of the tilt angle of the vibrators are shown in Fig. 3.

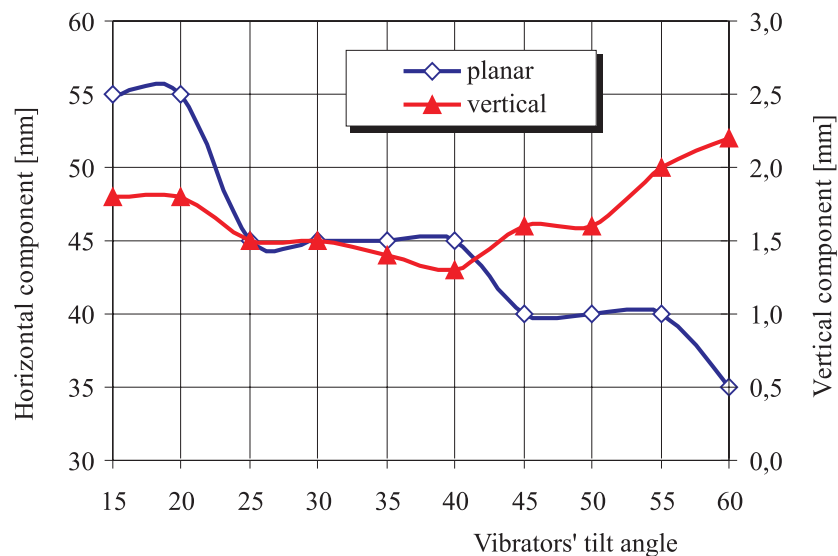


Fig. 3. Components of the calibrators' vibration measured from the laser light trace on the distant screen as a function of the vibrators' angle.

Movement of seeds in a screen segment of the column was measured on the following parts of a segment: (1) the conical funnel directing the seeds to the middle of the screen, (2,3) screen (both on and through) and (4) conical bottom element directing the seeds towards the chute, Fig. 2.

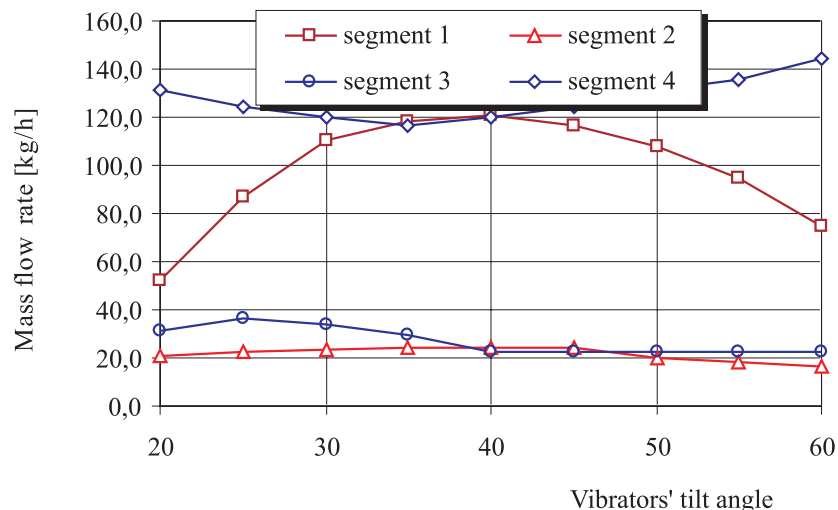


Fig. 4. Mass flow rate on various elements of the calibrator as a function of the vibrators' angle.

1. Our studies of a calibrator with two side vibrators tilted at the same angle, have shown that the screen is the element controlling the yield both for planar movement on the screen and for vertical movement through the screen.
2. The vibrators' tilt angle of 40° – 45° assures optimal performance of the device.
3. It was estimated that the average path of the seed on the screen is ca. 5 m, which grants sufficiently precise separation of the seeds in size fractions.

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