**Title** Mathematical model parameters for describing the particle size spectra of knife-milled corn stover

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**Abstract**

Particle size distributions of Corn stover (*Zea mays* L.) created by a knife mill were determined using integral classifying screens with sizes from 12.7 to 50.8 mm, operating at speeds from 250 to 500 rpm, and mass input rates ranging from 1 to 9 kg $min^{-1}$. Particle distributions were classified using American Society of Agricultural and Biological Engineers (ASABE) standardised sieves for forage analysis that incorporated a horizontal sieving motion. The sieves were made from machined-aluminium with their thickness proportional to the sieve opening dimensions. A wide range of analytical descriptors that could be used to mathematically represent the range of particle sizes in the distributions were examined. The correlation coefficients between geometric mean length and screen size, feed rate, and speed were 0.980, 0.612, and -0.027, respectively. Screen size and feed rate directly influenced particle size, whereas operating speed had a weak indirect relation with particle size. The Rosin–Rammler equation fitted the chopped corn stover size distribution data with coefficient of determination ($R^2$) > 0.978. This indicated that particle size distribution of corn stover was well-fit by the Rosin–Rammler function. This can be attributed to the fact that Rosin–Rammler expression was well suited to the skewed distribution of particle sizes. Skewed distributions occurred when significant quantities of particles, either finer or coarser, existed or were removed from region of the predominant size. The mass relative span was slightly greater than 1, which indicated that it was a 'borderline narrow to wide' distribution of particle sizes. The uniformity coefficient was <4.0 for 19.0–50.8 mm screens, which indicated particles of relatively uniform size. Knife mill chopping of corn stover produced 'fine-skewed mesokurtic' particles with 12.7–50.8 mm screens. Size-related parameters, namely, geometric mean length, Rosin–Rammler size parameter, median length, effective length, and size guide number, were well predicted at $R^2$ values of 0.981, 0.982, 0.979, 0.950 and 0.978, respectively as a function of knife mill screen size, feed rate, and speed. Results of this analysis of particle sizes could be applied to the selection of knife mill operating parameters to produce a particular size of corn stover chop, and could serve as a guide for the relationships among various analytic descriptors of biomass particle distributions.