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Protein-Enrichment of Oilseed Meals by Triboelectrostatic Separation

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Abstract : There is increasing importance to accelerate the transition to sustainable food systems by including environmentally friendly technologies. Our work focuses on protein enrichment and fractionation of agricultural side streams by dry triboelectrostatic separation technology. Materials are fed in particulate form into a system dispersed in a highly turbulent gas stream, whereby the high collision rate of particles against surfaces and other particles greatly enhances the electrostatic charge build-up over the particle surface. A subsequent step takes the charged particles to a delimited zone in the system where there is a highly uniform, intense electric field applied. Because the charge polarity acquired by a particle is influenced by its chemical composition, morphology, and structure, the protein-rich and fiber-rich particles of the starting material get opposite charge polarities, thus following different paths as they move through the region where the electric field is present. The output is two material fractions, which differ in their respective protein content. One is a fiber-rich, low-protein fraction, while the other is a high-protein, low-fiber composition. Prior to testing, materials undergo a milling process, and some samples are stored under controlled humidity conditions. In this way, the influence of both particle size and humidity content was established. We used two oilseed meals: lupine and rapeseed. In addition to a lab-scale separator to perform the experiments, the triboelectric separation process could be successfully scaled up to a mid-scale belt separator, increasing the mass feed from g/sec to kg/hour. The triboelectrostatic separation technology opens a huge potential for the exploitation of so far underutilized alternative protein sources. Agricultural side-streams from cereal and oil production, which are generated in high volumes by the industries, can further be valorized by this process.

Keywords : bench-scale processing, dry separation, protein-enrichment, triboelectrostatic separation
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