Influence of Particle Size on NIR Spectroscopic Characterization of Sorghum Biomass for the Biofuel Industry

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Background/Objective

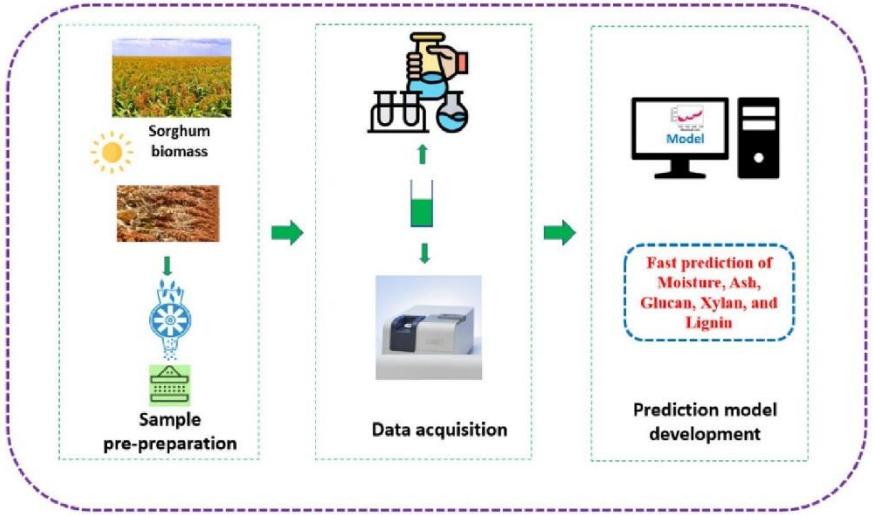
Near-infrared (NIR) spectroscopy is a rapid and accurate method for high-throughput biomass characterization, including sorghum (*Sorghum bicolor*), a promising biofuel energy crop. Selecting appropriate sorghum biomass feedstock is important in biofuel production since its biochemical traits affect the type and amount of biofuel conversion, and rapid analysis is essential for real-time biomass screening and quality control. This study assessed the influence of particle size on NIR analysis of sorghum biomass composition.

Approach

113 types of genetically diverse sorghum accessions were dried, ground, and sieved (<250, 250–600, 600–850, and > 850 µm particle size) for developing partial least square regression (PLSR) prediction models for moisture, ash, extractive, glucan, xylan, acid-soluble lignin (ASL), acid-insoluble lignin (AIL), and total lignin (ASL+AIL).

Results

Particle size significantly impacted the accuracy of NIR spectroscopic prediction models. Overall, smaller particle sizes provided better model performance, while no single particle size provided the best performance for all the components. Using PMSR models based on selected wavelengths with the smallest particle size (<250) the best performance for ash and extractives was achieved. At the same time, glucan, AIL and lignin results were satisfactory for screening purposes.



Graphical abstract of the study.

Significance/Impacts

This study showed that size reduction combined with selected important wavelength models could improve NIR spectroscopic analysis for developing portable, in-field screening instruments for lipid-producing sorghum biomass for the biofuel industry.

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