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Abstract Title: Parameter Sensitivity and Model Fitting for Corn Leaf Moisture using a Modified GAB Isotherm

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Abstract:

Water activity (aw) was a critical factor influencing microbial growth, enzymatic reactions, and the overall stability of grain corn during storage. In ruminant nutrition, steeping corn prior to feeding was commonly practiced enhancing digestibility and feed efficiency. Research indicated that steeping corn improved starch gelatinization and nutrient accessibility, leading to better feed utilization in livestock. However, this process also increased the moisture content and, consequently, the water activity of the grain, thereby elevating the risk of spoilage, particularly under warm and humid conditions. This study characterized the moisture sorption behavior of corn by constructing sorption isotherms and modeling the relationship between moisture content and water activity using the Guggenheim–Anderson–de Boer (GAB) equation. A custom static gravimetric system equipped with temperature and humidity sensors was setup to equilibrate corn samples under controlled relative humidity conditions created using saturated salt solutions. At equilibrium, the moisture content of the samples was determined gravimetrically, while water activity was measured using a calibrated water activity meter. The data were fitted to the GAB model using non-linear regression to estimate the monolayer moisture content (Mo), the Guggenheim constant (C), and the multilayer factor (K). These parameters provided insights into critical moisture thresholds associated with microbial growth and spoilage potential, offering predictive value for corn stability under various storage scenarios. The outcomes of this research provided a foundational understanding of the sorption behavior of steeped corn grain and supported the development of moisture control strategies that balance digestibility benefits with spoilage prevention in feed management systems.