

Yu, P., Damiran, D., Nuez Ortin. W., 2009. Characterization of protein structure of the new co-products from bioethanol production in western Canada using DRIFT Spectroscopy: comparison among blend DDGS, wheat DDGS and corn DDGS, between wheat and wheat DDGS, and corn and corn DDGS [abstract]. In: Abstract for the 2009 Joint ADSA-CSAS-ASAS Annual Meeting. July 12-16, 2009. Montreal, Quebec, Canada.

Characterization of protein structure of the new co-products from bioethanol production in western Canada using DRIFT Spectroscopy: Comparison among blend DDGS, wheat DDGS and corn DDGS, between wheat and wheat DDGS, and corn and corn DDGS

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The objective of this study was to use DRIFT spectroscopy as a novel approach to identify difference in protein molecular structure in term of amide profile between wheat and wheat DDGS, between corn and corn DDGS, between bioethanol plants, and among wheat DDGS, corn DDGS and blend DDGS. The items assessed included protein amide I, amide II and amide I-to-II ratio. The protein IR spectrum has two primary features, the protein amide I (ca. 1600-1700 cm^{-1}) and amide II (ca. 1500-1560 cm^{-1}) bands. The amide I and II profile depends on the protein molecular structural chemical make-up and they are usually affected by processing methods and condition. The hypothesis was that protein molecular structure (chemical make-up) was changed after bioethanol processing and these changes affected DDGS nutritive value. Results showed that using DRIFT spectroscopy, the protein molecular structural makeup was revealed and identified. Amide I peak area significantly differed between wheat and wheat DDGS (162.5 vs. 291.8 KM unit, $P < 0.05$), corn and corn DDGS (64.4 vs. 261.8 KM unit, $P < 0.05$), wheat and corn ($P < 0.05$). No difference ($P > 0.05$) among wheat DDGS, corn DDGS and blend DDGS was detected. The amide II peak area significantly differed between wheat and wheat DDGS (35.1 vs. 95.0 KM unit, $P < 0.05$), and corn and corn DDGS (14.1 vs. 118.5 KM unit, $P < 0.05$). No differences ($P > 0.05$) between wheat and corn and among wheat DDGS, corn DDGS and blend DDGS were found. Amide I-to-II ratios significantly differed between wheat and wheat DDGS (4.61 vs. 3.08, $P < 0.05$), corn and corn DDGS (4.56 vs. 2.21, $P < 0.05$). No differences ($P > 0.05$) between wheat and corn, between bioethanol plants but significant differences among wheat DDGS, blend DDGS and corn DDGS were detected. These results indicated that bioethanol processing changes the original protein molecular structure (chemical make-up), which may play a major role to determine nutritive value.

KEYWORDS

Protein Structure and Amide I to II ratio, DDGS, Molecular Spectra