Institute of Environmental Technology and Energy Economics

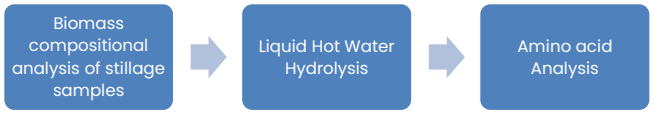
PROTEIN EXTRACTION FROM BIOETHANOL BY-PRODUCTS FOR HUMAN CONSUMPTION USING LIQUID HOT WATER PRETREATMENT

Monica Cornejo, Martin Kaltschmitt

Motivation and Introduction

- Growing global demand for sustainable, plant-based protein sources [1]
- Declining availability of arable land caused by climate change and soil degradation
- Dried distillers grains (DDG), a by-product of bioethanol production has a protein content between 20-40%
- Potential for sustainable valorization of stillage as a protein source for human consumption
- Liquid Hot Water (LHW) treatment for protein recovery : chemical-free pretreatment method
- Improved solvation properties due to changes of its chemical and physical properties [2]

Methodology



Results

Biomass compositional analysis

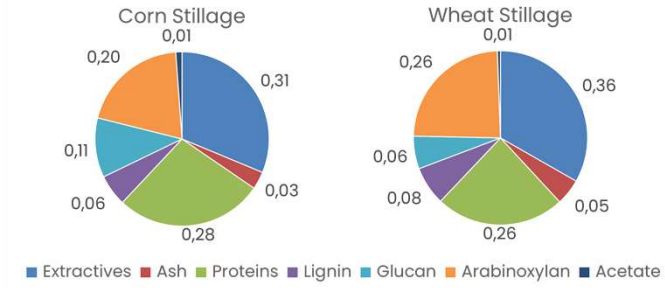


Image 1: Results of compositional analysis of corn and wheat DDG from bioethanol production based on the dry weight

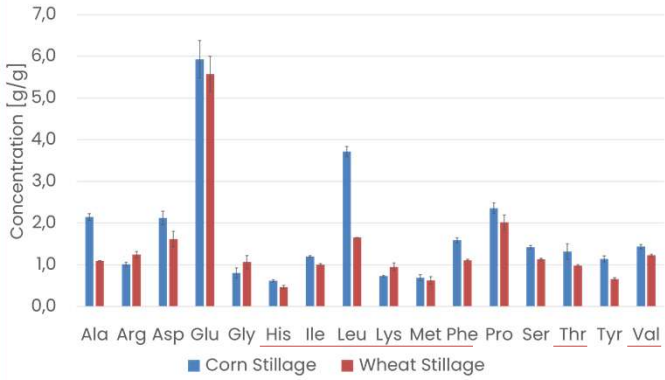


Image 2: Concentration of 16 Amino acids in corn and wheat DDG

Table 1: Phenolic compounds in corn and wheat DDG

Sample	Vanillin [mg/L]	p-Coumaric Acid [mg/L]	Ferulic Acid [mg/L]
Wheat DDG	<2	2,6	39
Corn DDG	2,1	13,5	110

Liquid Hot Water Treatment

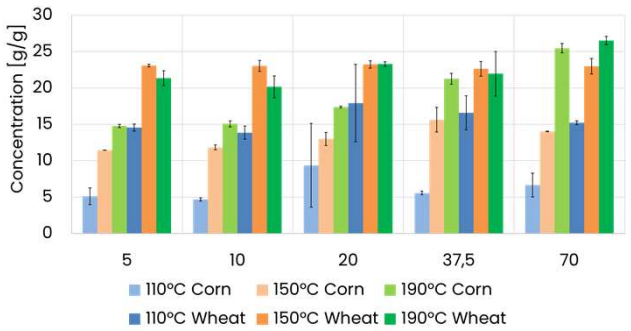


Image 3: Protein concentration of hydrolysates after hydrothermal pretreatment at 110, 150 and 190° C from 5 to 70 min

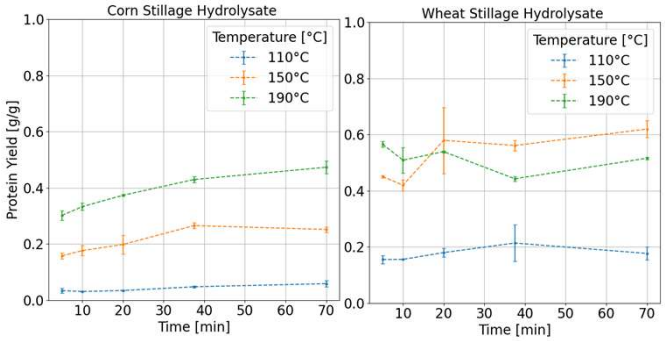


Image 4: Total protein yield in hydrolysate after hydrothermal pretreatment of corn and wheat DDG at 110, 150 and 190° C from 5 to 70 min

Conclusion

The optimal pretreatment conditions vary between corn and wheat DDG. Corn DDG yielded the highest protein recovery at 190° C, whereas wheat stillage showed better results at a lower temperature of 150° C.

Protein concentration in the hydrolysate remains low, indicating the presence of other valuable compounds. Further research is needed to characterize these components for potential applications.

References

[1] T. Kirner and B. Manns, "Nachhaltige Ernährung der Zukunft - Beitrag alternativer Proteinquellen," in Die UN-Nachhaltigkeitsziele als interdisziplinäre Herausforderung: Aufgaben, Aspekte und Ansätze, S. Beier, P. Hense, C. Klümper, S. Lechtenböhmer, and C. Reicher, Eds., Wiesbaden: Springer Fachmedien Wiesbaden, 2024, pp. 139–155.
[2] B. Yang, L. Tao, and C. E. Wyman, "Strengths, challenges, and opportunities for hydrothermal pretreatment in lignocellulosic biorefineries," Biofuels, Bioproducts and Biorefining, vol. 12, no. 1, pp. 125–138, 2018

TUHH Hamburg University of Technology
IUE

Hamburg University of Technology
Am Schwarzenberg-Campus 1
21073 Hamburg

T. +49 40 42878 3322
F. +49 40 42878 3322
E. monica.cornejo@tuhh.de

Institute of Environmental Technology and Energy Economics
Building N, Room 2036