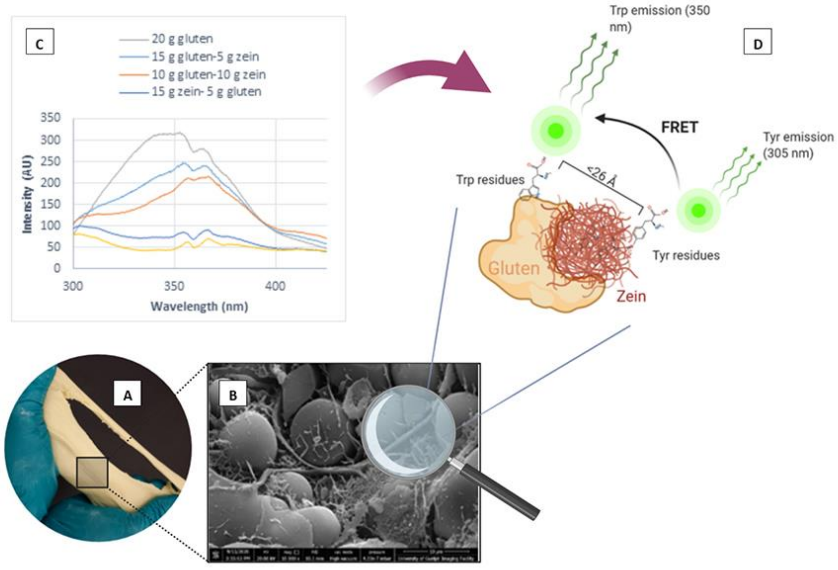
Gluten and zein interactions: A vibrational and fluorescence spectroscopy study

Azin Sadat[1], Maria Corradini[2,1], and Iris Joye[1]

1. University of Guelph, Guelph, Ontario, Canada
2. Arrell Food Institute, Guelph, Ontario, Canada

The volume spanning network formed by gluten during breadmaking is crucial for the end product quality. Zein proteins are also capable of forming a protein network when mixed above their glass transition temperature and could, hence, be a high performing alternative to gluten. Vibrational (FTIR and Raman scattering) and fluorescence spectroscopy are believed to be powerful, non-invasive methods capable of assessing protein structure in complex cereal systems. The objective of this project is to explore the suitability of the above techniques to study complex zein-gluten dough systems. The dough was prepared by mixing 20 w/w% of protein (with different proportions of zein and gluten) and 80 w/w% of corn starch. The tyrosine (Tyr) fluorescence emission peak (λ_{exc} =280 nm) was still present even in those zein-gluten samples containing the highest gluten concentration and lowest zein concentration. This suggests that the Tyr moieties (stemming from Tyr residues in zein) are not in close proximity to tryptophan (Trp) of gluten and their fluorescence is not quenched efficiently. Raman scattering results also showed the presence of different Tyr residues, exposed and buried, in zein and gluten samples. These results indicate that two distinct network structures of gluten and zein are formed in the dough system. These two distinct networks (fibrillar and sheet-like) were observed in the SEM images as well. The presence of a variable content of secondary structures and different conformations of disulfide bridges between different dough samples have also been observed. The present work provides valuable insights into the protein conformation and interactions in zein-gluten dough systems.



(A) A zein-gluten dough sample (B) SEM image of a zein-gluten dough sample (C) Fluorescence spectra of dough samples with different proportions of gluten and zein; λexc 280 nm, λem 300 - 425 nm (D) Schematic representation of Förster resonance energy transfer (FRET) from zein tyrosine (Tyr) residues to gluten tryptophan (Trp) residues.