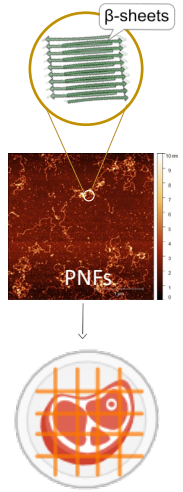
Protein Nanofibrils for Sustainable Food–Characterization and Comparison of Fibrils from a Broad Range of Plant Protein Isolates

Anja Herneke*, Christofer Lendel, Daniel Johansson, William Newson, Mikael Hedenqvist, Saeid Karkehabadi, David Jonsson, and Maud Langton

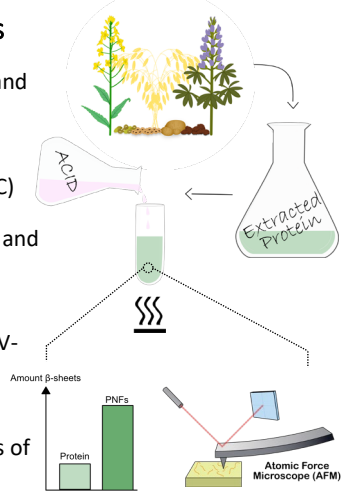
Background/introduction/summary

- There is a great need to develop more sustainable food
- Texture makes the food appetizing
- **Protein nanofibrils (PNFs)** have demonstrated many useful applications within the material sciences due to their positive impact on the strength and stiffness of the material
- PNFs are characterized by a high content of β-sheets, packed in a cross-β structure and linked together with hydrogen bonds
- **Aim:** Generate new sustainable texturized food application from plant-based protein nanofibrils



Materials and Methods

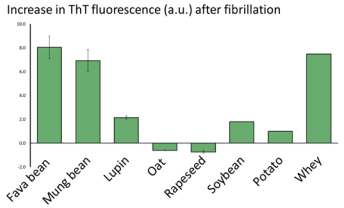
- Plant protein extraction and purification
- Plant protein characterization (SDS, SEC)
- Generating PNFs (low pH and high temperature)
- Characterizing secondary structure of PNFs (ThT, UV-CD, FTIR)
- Determination of morphological alterations of PNFs (AFM)

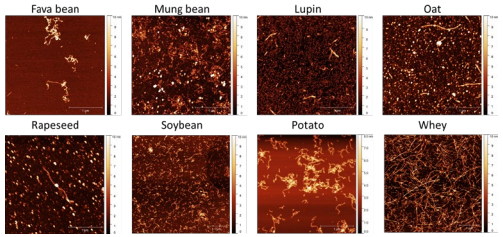


Results

We were able to extract protein and generate PNFs from fava bean, mung bean, lupin, oat and rapeseed, potato, soybean. This was compared with protein and PNFs from whey.

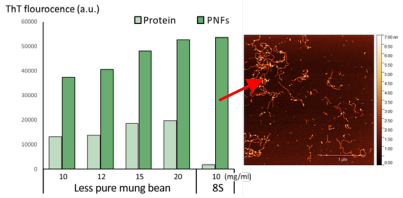
Secondary structure analysis
ThT is a fluorescent dye that binds to PNFs. ThT assay showed an increase in fluorescent after fibrillation for all proteins except oat and rapeseed. However, the presence of PNFs in the fibrillated sample from oat and rapeseed was confirmed with UV-CD, FTIR and AFM.





Morphology of PNFs
The PNFs differed in length and morphology (curly/straigth). The reason that whey is dominant in forming many and long PNFs are probably due to that the major protein is small and the protein isolate is pure.

Purity and size of protein affect the ability to form PNFs
We proved this hypothesis by generating a pure isolate from the major protein in mung bean 8S. PNFs from 8S generated a higher ThT response at lower concentrations and longer PNFs compared to the less pure protein from mung bean.



Conclusions

- ThT assay has limitations as detection method of PNFs
- We were able to characterize PNFs from 7 different plant-based proteins
- AFM confirmed different morphologies among these PNFs
- Size and purity of protein affect the ability to form PNFs
- One step closer to understand how to use plant-based PNFs in a food application

Reference

Herneke et al. 2021
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Contact

PhD student
Anja Herneke
anja.herneke@slu.se

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Chalmers | LTH | RISE | SLU | OrU