



Aalborg Universitet

AALBORG UNIVERSITY
DENMARK

Peptide emulsifiers from potato: Structure/function and targeted release

Gregersen Echers, Simon; García Moreno, Pedro Jesús; Yesiltas, Betül; Jafarpour, Ali; Bjørlie, Mads; Hansen, Egon Bech; Marcatili, Paolo; Jacobsen, Charlotte; Jones, Nykola C; Hoffmann, Søren Vrønning; Wimmer, Reinhard; Overgaard, Michael Toft

Creative Commons License
CC BY-NC-ND 4.0

Publication date:
2022

Document Version
Accepted author manuscript, peer reviewed version

[Link to publication from Aalborg University](#)

Citation for published version (APA):

Gregersen Echers, S., García Moreno, P. J., Yesiltas, B., Jafarpour, A., Bjørlie, M., Hansen, E. B., Marcatili, P., Jacobsen, C., Jones, N. C., Hoffmann, S. V., Wimmer, R., & Overgaard, M. T. (2022). *Peptide emulsifiers from potato: Structure/function and targeted release*. Abstract from 2nd NIZO Plant Protein Functionality Conference, Netherlands.

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal -

Take down policy

If you believe that this document breaches copyright please contact us at vbn@aub.aau.dk providing details, and we will remove access to the work immediately and investigate your claim.

Peptide emulsifiers from potato: Structure/function and targeted release

Simon GREGERSEN¹, Pedro J GARCÍA-MORENO^{2,3}, Betül YESILTAS², Ali JAFARPOUR², Mads BJØRLIE², Egon B. HANSEN², Paolo MARCATILI⁴, Charlotte JACOBSEN², Nykola C. JONES⁵, Søren V. HOFFMANN⁵, Reinhard WIMMER¹, Michael T. OVERGAARD¹

¹Department of Chemistry and Bioscience, Aalborg University, 9220 Aalborg, Denmark

²National Food Institute, Technical University of Denmark, 2800 Kgs. Lyngby, Denmark

³Department of Chemical Engineering, University of Granada, 18003 Granada, Spain

⁴Department of Bio and Health Informatics, Technical University of Denmark, 2800 Kgs. Lyngby, Denmark

⁵ISA, Department of Physics and Astronomy, Aarhus University, 8000 Aarhus, Denmark

Plant proteins and derived peptides are gathering tremendous interest as green, sustainable, functional, and nutritional replacements for chemical additives in foods. If such proteins and peptides can furthermore be derived as side-streams from existing industrial processes, the techno-economical and sustainability perspectives increase further. Potato (*Solanum tuberosum*) is an excellent example of such a crop. Globally, the production of potato starch exceeds 3,000,000 MT annually with more than 200,000 MT of potato protein isolated as a side-stream. However, direct isolation of food-grade, functional protein is in many cases regarded cost-ineffective.

Through amphiphilicity-based bioinformatic prediction, a large number of peptide emulsifiers embedded in abundant potato proteins were identified and validated *in vitro*. Amongst these, especially one peptide ($\gamma 1$), derived from the storage protein patatin, showed exceptional emulsifying properties. Patatin, however, it is not a single protein, but a family of highly homologous isoforms, thereby introducing natural variability in obtainable peptides. Using bottom-up proteomics and *in silico* sequence analysis, we identified numerous natural $\gamma 1$ variants, which were produced synthetically and investigated for interfacial properties and physical stability of emulsions during storage. Furthermore, the interfacial conformation of the peptides was investigated by SRCD and supplemented by NMR and benchtop CD for selected peptides in micellar model systems. Through these investigations, we provide novel insight on structure/function relationship of amphipathic, α -helical peptide emulsifiers but are also able to evaluate the full potential of using $\gamma 1$ and variants as peptide emulsifiers in food. Ultimately, this knowledge was employed to design a scalable and targeted enzymatic hydrolysis, using *in silico* proteolysis. The process resulted in a hydrolysate with improved emulsifying properties compared to other potato protein hydrolysates and used as emulsifier in efficient microencapsulation of fish oil through spray-drying resulting in capsules with high physical and oxidative stability during storage.