



Aalborg Universitet

AALBORG UNIVERSITY
DENMARK

A potent peptide emulsifier from potato storage proteins and its natural isoforms

Insight into the structure/function relationship of amphipathic, -helical peptide emulsifiers, their targeted release, and applicability.

Gregersen, Simon

Creative Commons License
CC BY 4.0

Publication date:
2022

Document Version
Publisher's PDF, also known as Version of record

[Link to publication from Aalborg University](#)

Citation for published version (APA):

Gregersen, S. (2022). *A potent peptide emulsifier from potato storage proteins and its natural isoforms: Insight into the structure/function relationship of amphipathic, -helical peptide emulsifiers, their targeted release, and applicability..* Abstract from 18th Food Colloids Conference, Lund, Sweden.

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.

A potent peptide emulsifier from potato storage proteins and its natural isoforms: Insight into the structure/function relationship of amphipathic, α -helical peptide emulsifiers, their targeted release, and applicability.

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

Peptide emulsifiers derived from plant proteins are gathering growing interest as green and sustainable replacements for chemical additives in food. Potato (*Solanum tuberosum*) is one of the most important crops for both human consumption and industrial processing. Globally, the annual production of potato starch exceeds 3,000,000 MT with more than 200,000 MT of potato protein isolated as a side-stream, providing an enormous source of raw protein. The direct isolation of food-grade protein is in many cases regarded as cost-ineffective. Nevertheless, potato proteins may be a valuable source of functional peptides.

Previously, we demonstrated amphiphilicity-based bioinformatic prediction of peptide emulsifiers embedded in potato proteins^{1,2}. Amongst the predicted peptides, especially one (γ 1), derived from the storage protein patatin, showed exceptional emulsifying activity *in vitro*. Although patatin is the most abundant protein in potatoes, it is not a single protein, but a family of highly homologous isoforms.

Using bottom-up proteomics in combination with multiple sequence alignment and *in silico* digestion, we identified several γ 1 variants. The variants consist of both full-length isoforms with single amino acid substitutions and tryptic variants/truncations from different patatin isoforms. The emulsifying activity of the γ 1 variants, physical stability of the emulsions during storage, and interfacial properties were investigated³. 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.

Based on these results, we are able to i) evaluate the full potential of using γ 1 variants as peptide emulsifiers in food; ii) provide novel insight on the structure/function relationship of amphipathic, α -helical peptide emulsifiers; iii) combine *in vitro* functional validation with *in silico* proteolysis to design a scalable and targeted enzymatic hydrolysis, resulting in a hydrolysate with improved emulsifying properties; and iv) apply the hydrolysates as stabilizers for encapsulation of fish oil for foods.

¹García-Moreno, Pedro J., et al. "Emulsifying peptides from potato protein predicted by bioinformatics: Stabilization of fish oil-in-water emulsions." *Food Hydrocolloids* 101 (2020): 105529. <https://doi.org/10.1016/j.foodhyd.2019.105529>

²García-Moreno, Pedro J., et al. "Identification of emulsifier potato peptides by bioinformatics: application to omega-3 delivery emulsions and release from potato industry side streams." *Scientific reports* 10.1 (2020): 1-22. <https://doi.org/10.1038/s41598-019-57229-6>

³García-Moreno, Pedro J., et al. "The structure, viscoelasticity and charge of potato peptides adsorbed at the oil-water interface determine the physicochemical stability of fish oil-in-water emulsions." *Food Hydrocolloids* 115 (2021): 106605. <https://doi.org/10.1016/j.foodhyd.2021.106605>