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Production of emulsifying peptides from seaweed protein by enzymatic hydrolysis

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During the recent years global food trends toward sustainability and clean label have emerged. Together with consumer demand for natural ingredients there is a need for alternatives to the commonly used synthetic emulsifiers. An alternative could be protein and protein hydrolysates. The industrial production of carrageenan results in a protein-rich side-stream which is currently underutilized. The aim of this study was to produce protein hydrolysates from an industrial seaweed side-stream and to test their ability to physically stabilize a 5% fish oil-in-water (O/W) emulsions. The hydrolysates' emulsifying activity were also predicted using the bioinformatics tool EmulsiPred, which predicts the emulsifying activity based on amino acid sequence and secondary structure. Protein hydrolysates were produced with the industrial available enzymes; Alcalase, Neutrase, Protamex, Flavourzyme, and Trypsin (TRY). It was possible to produce hydrolysates with reasonable yields (30-43%) during 4 hours of hydrolysis for 4 out of the 5 tested enzymes. From the proteomics and bioinformatics analysis, all the produced hydrolysates contained amphiphilic peptides, but the abundance depended on the used protease. This suggested that the hydrolysates could form and stabilize O/W emulsion, but the stability would differ between the samples. This was confirmed during experimental testing. The tested hydrolysates could stabilize emulsions with no significant increase in droplet size ($D_{3,2}$) over 14 days of storage. After 14 days of storage emulsions created with TRY was similar to casein ($D_{3,2}=0.27\mu\text{m}$) however creaming was observed in the emulsion. All emulsions containing hydrolysates also had greater absolute zeta potential compared to casein, suggesting better electrostatic repulsion between droplets. TRY decreased the oil-water interfacial tension more compared to the other hydrolysates and casein. Based on the findings of this study seaweed protein hydrolysates could be used as a vegan and natural emulsifier to stabilize low fat O/W emulsions.