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Title of thesis	Extrusion-aided Faba Bean Protein Fractionation	
Programme	Biological and Chemical Engineering for a Sustainable Bio-economy	
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Abstract

Sustaining the availability of plant-based protein alternatives to meet the growing demand is crucial. Texturized vegetable protein (TVP) is one of the plant-based alternatives available; however, the production of TVP involves energy and water-intensive processes for protein enrichment of the raw material. The state-of-the-art dry-extrusion-aided plant protein fractionation process, recently patented by VTT, presents a promising alternative for the existing protein-enrichment methods. However, despite of its potential, there is limited knowledge regarding the impact of extrusion conditions on the properties of the produced fractions. Thus, this thesis aims at identifying extrusion conditions favouring starch-protein separation, focusing on the utilization of the untapped potential of Faba bean (*Vicia faba*), a locally cultivated legume known for its high protein content.

Through process optimization, different conditions favouring high protein content and high protein yields in the protein-rich fraction were identified. The optimized conditions for protein content yielded a protein content of 76.78% with a protein yield of 59.84%. Additionally, when the focus shifted towards maximizing protein yield, a protein yield of 84.85% with a corresponding protein content of 71.02% was obtained. Notably, these results were relatively higher than protein concentrate and TVP available in the market.

Moreover, the optimized conditions not only resulted in high protein content and yield of protein-rich extrudates, but also demonstrated comparable techno-functional properties to commercial TVP. Additionally, the extent of protein texturization during the extrusion process determined the techno-functional attributes of the protein-rich fraction.

The dry extrusion-aided fractionation process is expected to be a more sustainable approach compared to conventional TVP production by bypassing resource-intensive flour fractionation. This research contributes valuable insights into facilitating the development of innovative and more sustainable plant-based protein alternatives.

Keywords Plant-based protein; Faba bean; Texturized-vegetable proteins

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Abstract (Estonian)

Kasvava nõudluse rahuldamiseks on väga oluline tagada taimse valgu alternatiivide kättesaadavus. Tekstureeritud taimne valk (TVP) on üks olemasolevatest taimsetest alternatiividest, kuid TVP tootmine hõlmab energia- ja veemahukaid protsesse tooraine valgu rikastamiseks. VTT poolt hiljuti patenteeritud kaasaegne kuivekstrusiooni abil toimuv taimse valgu fraktsioneerimise protsess on paljulubav alternatiiv olemasolevatele valgu rikastamise meetoditele. Vaatamata selle potentsiaalile on siiski piiratud teadmised ekstrusioonitingimuste mõju kohta toodetud fraktsioonide omadustele. Seega on käesoleva väitekirja eesmärk kindlaks teha tärglise ja valkude eraldamist soodustavad ekstrusioonitingimused, keskendudes Faba oa (*Vicia faba*), kohalikult kasvatatud ja kõrge valgusisalduse poolest tuntud kaunvilja, seni kasutamata potentsiaali ärakasutamisele.

Protsessi optimeerimise abil määrati kindlaks erinevad tingimused, mis soodustavad suurt valgusisaldust ja suurt valgurikka fraktsiooni valgusaagist. Valgusisalduse suhtes optimeeritud tingimused andsid 76,78 % valgusisalduse ja 59,84 % valgusaagise. Lisaks sellele, kui keskenduti valgusaagise maksimeerimisele, saadi valgusaagis 84,85 % ja vastav valgusisaldus 71,02 %. Need tulemused olid suhteliselt kõrgemad kui turul saadaolevad valgukontsentraadid ja TVP.

Lisaks sellele ei andnud optimeeritud tingimused mitte ainult kõrget valgusisaldust ja valgurikka ekstrudraadi saagist, vaid näitasid ka võrreldavaid tehnilis-funktsionaalseid omadusi kaubandusliku TVPga. Lisaks sellele määras valgurikka fraktsiooni tehnofunktsionaalsed omadused kindlaks valgu tekstureerimise ulatus ekstrusiooniprotsessi käigus.

Eeldatakse, et kuiv ekstrusiooni abil toimuv fraktsioneerimisprotsess on tavapärase TVP tootmisega võrreldes jätkusuutlikum lähenemisviis, kuna sellega välditakse ressursimahukat jahu fraktsioneerimist. See uuring annab väärtusliku panuse uuenduslike ja jätkusuutlikumate taimse valgu alternatiivide väljatöötamise hõlbustamisse.

Keywords Taimne valk; Faba oad; Tekstuuritud taimne valk.
