“Quality Assessment of Canola Protein for the Production of Bio-based Plastics”

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16th International Rapeseed Congress

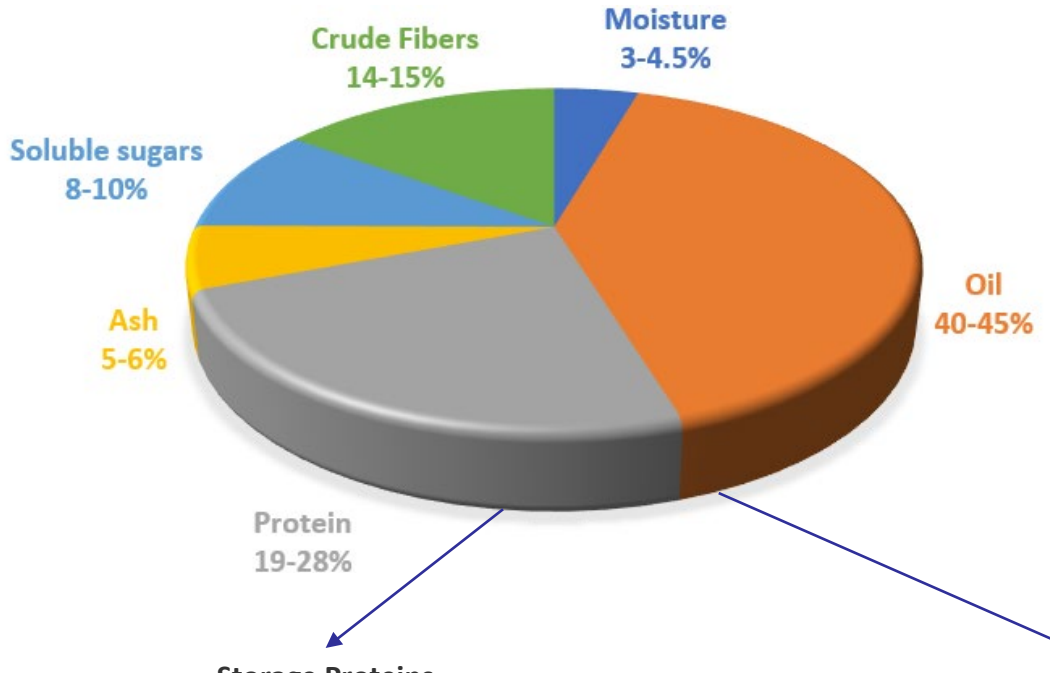
September 2023

College of Agriculture and Bioresources

Outline

- Introduction
- Methods
- Characterization of proteins
- Polymers and bio-based plastics

Composition of canola seed



Storage Proteins

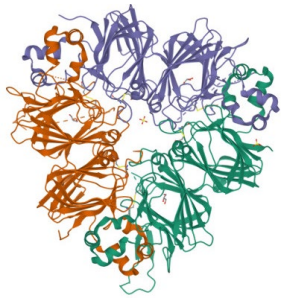
NAPIN: 2S albumin

Two polypeptide chains with MW of 9 and 4 kDa held together by disulfide bonds

Protein Data base PDB. Rico et al. 1996

CRUCIFERIN: Globulin

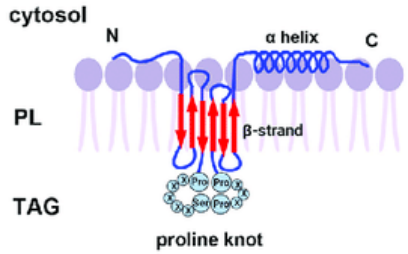
MW: 20-40 kDa



Structural Protein

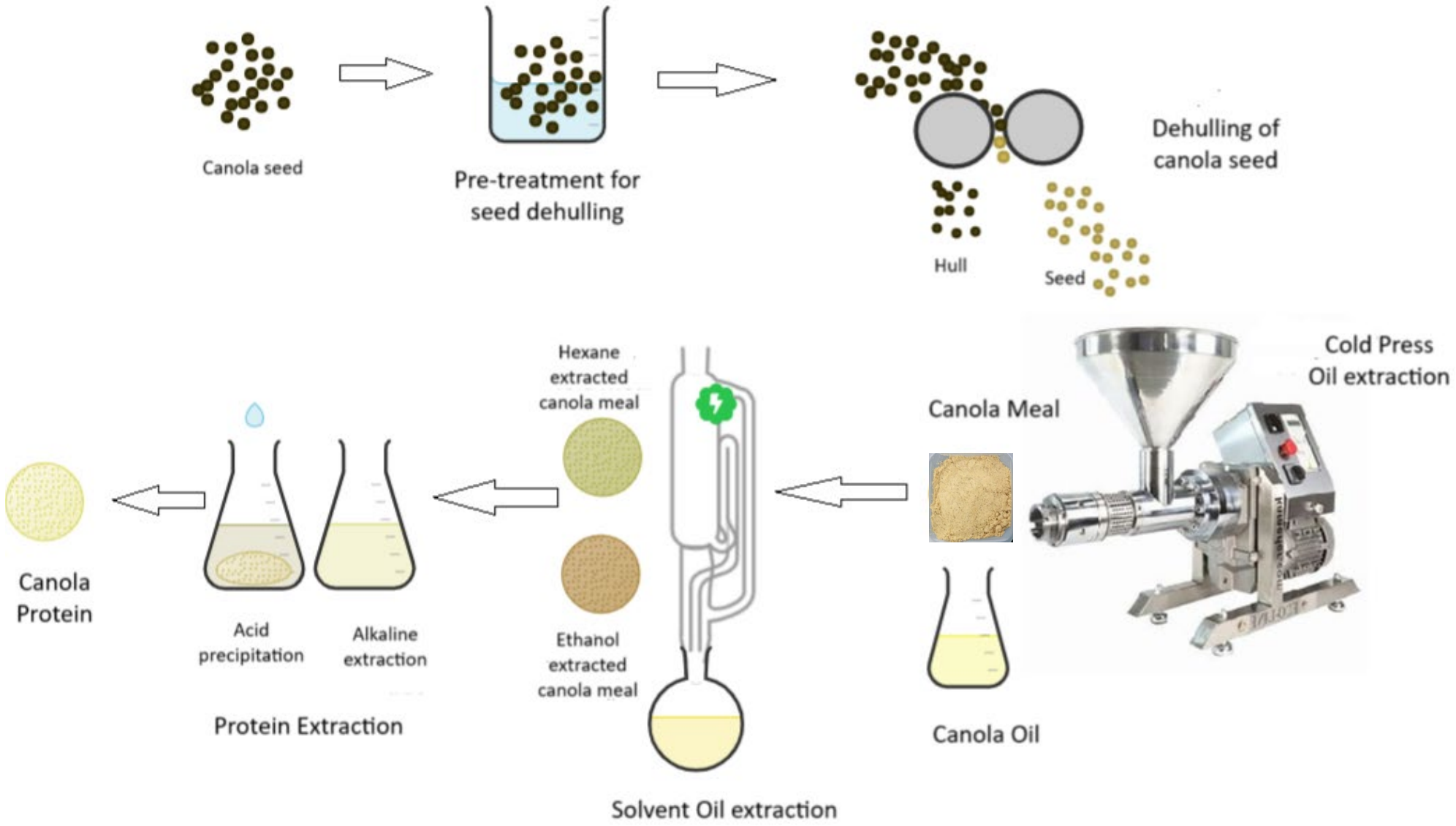
OLEOSIN

MW: 16 to 24 kDa



Shao et al. 2019

Methods

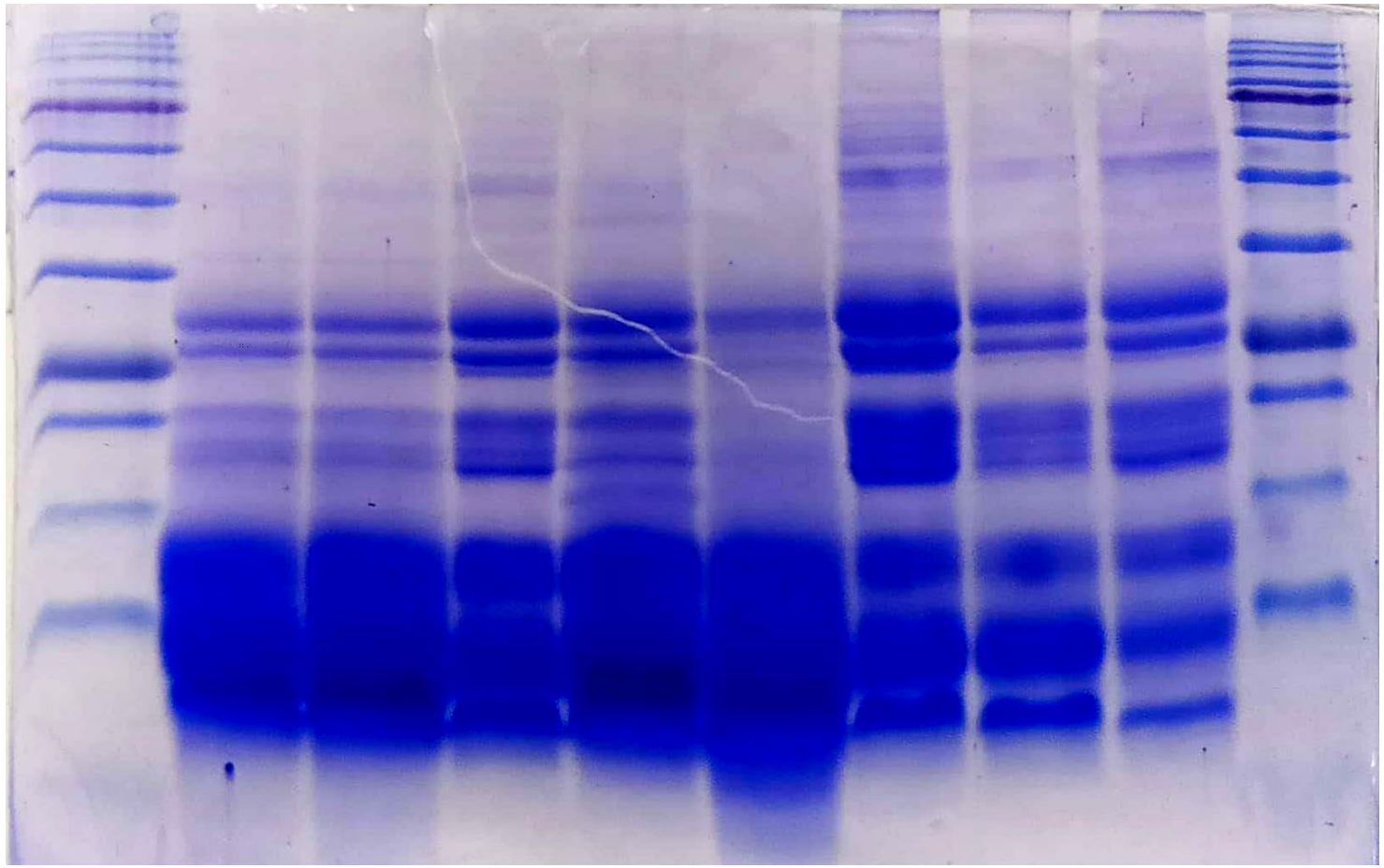

Canola seed
Pre-treatment for seed dehulling
Dehulling of canola seed
Hull
Seed
Cold Press Oil extraction
Canola Meal
Hexane extracted canola meal
Ethanol extracted canola meal
Solvent Oil extraction
Canola Oil
Canola Protein
Acid precipitation
Alkaline extraction
Protein Extraction

Characterization of Proteins

- Protein Content – Kjehldhal method

	Name of sample	Protein content (%)
Protein ECM	Ethanol Liquid extract	66.67
	Ethanol Cruciferin pH 4	96.92
Protein HCM	Hexane Liquid extract	63.81
	Hexane Cruciferin pH 4	92.37
Commercial	Puratien HS	90.83

Molecular Weight Determination



Cruciferin
MW: 20-40 KDa

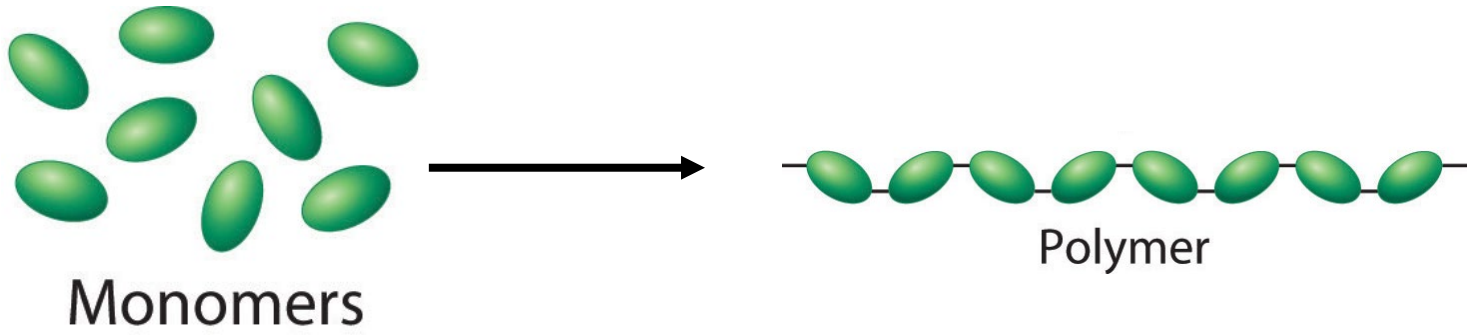
Napin
MW: 4-9 KDa

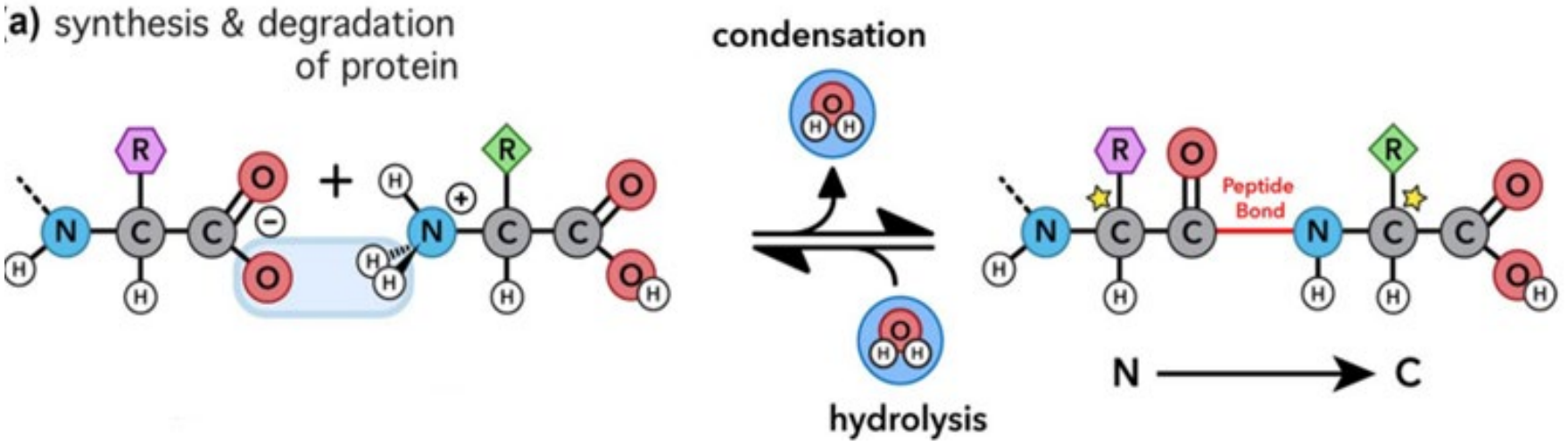
KDa: Kilodalton

Particle size and Zeta potential

	Sample Name	Zeta potential	Particle size (um)	Protein solubility at pH 7
Protein ECM	Ethanol Liquid Extract	−14.42	84.66	0.0196
	Ethanol Cruciferin pH 4	−30.67	40.30	0.0029
Protein HCM	Hexane Liquid extract	−12.98	49.16	0.0398
	Hexane Cruciferin pH 4	−24.60	35.08	0.0024
Commercial	Puratien HS	-−21.98	16.77	0.0320

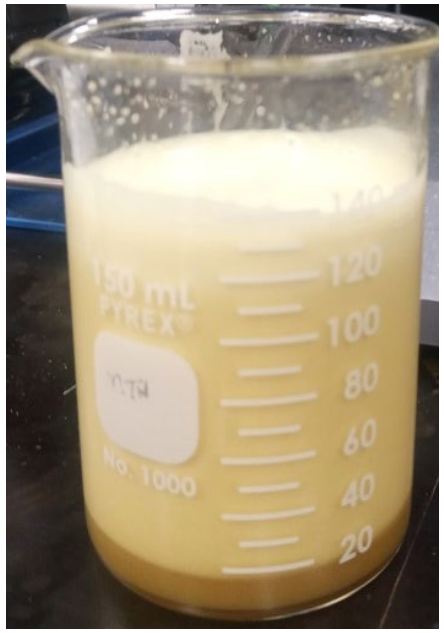
Proteins are Polymers





Runnels et al. 2018

Polymer Casting

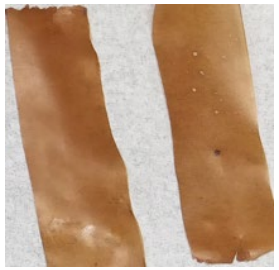


Preparation of the polymeric solution

Moulding

Film

Bio-based plastics

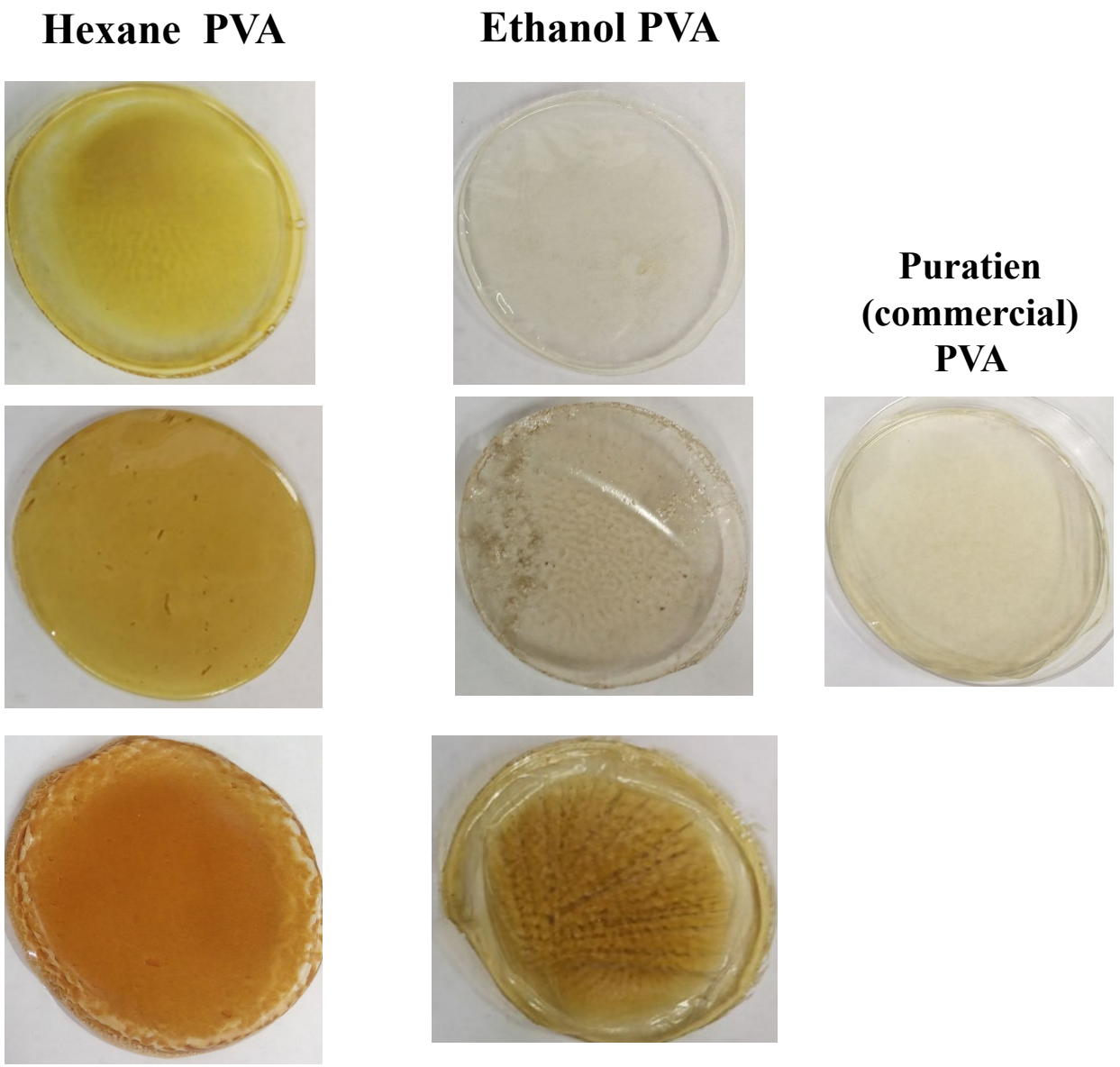
	4L	4E
Protein ECM		
Protein HCM		
Puratien HS (Commercial)		

Composition

- 5% w/w canola protein isolate
- Plasticizer – sorbitol or glycerol
- Additives to improve the properties of the plastic.

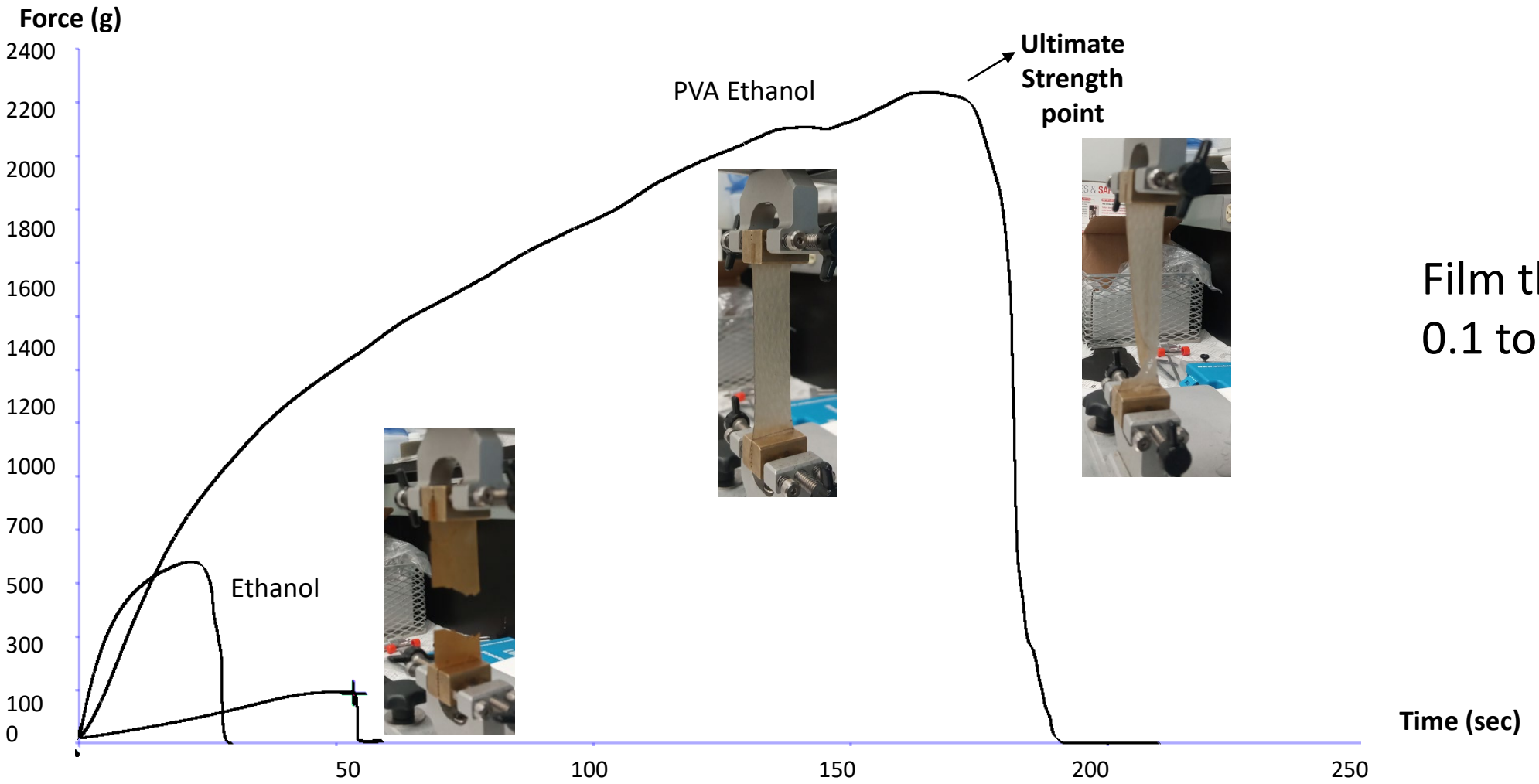
pH: 3, 7 and 9
Temperature: $70^{O}C$

Bio-based plastics with Polyvinyl Alcohol (PVA)



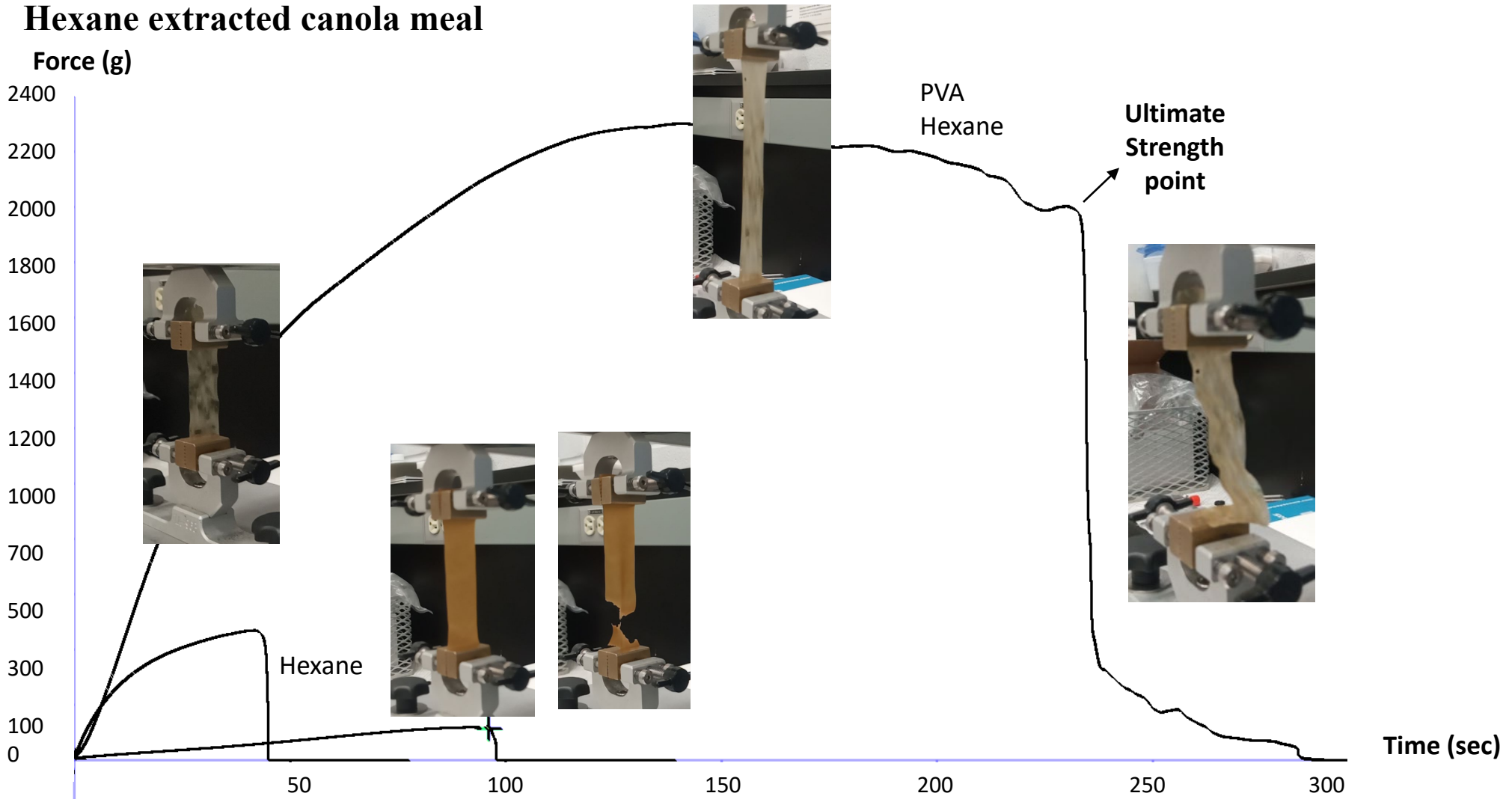
Mechanical properties
Tensile Strength and Elongation at break

Ethanol extracted canola meal



Film thickness:
0.1 to 0.2 mm

Tensile Strength and Elongation at break



Summary

- Canola meal contains a high quantity of protein that can be isolated to be used for other purposes different as animal feeding.

- The mechanical properties of the bio-based plastics depends on the quality and the type of extraction of the canola protein.

References

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Acknowledgments

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Thank You