

SE-HPLC as a tool to guide the production of novel peptide fractions for textile application

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Introduction

- Textile industry needs more bio centered solutions - the industry needs to adopt circular economy principles to repurpose its by-products;
- There is a need to re-utilize leather by-products and to develop biobased products^{1,2};
- SE-HPLC aids in the selection and production of peptide-rich solutions, these solutions are intended for use as functional coatings in textiles.
- This methodology helps optimize the formulation of coatings for desired functional properties.

Objectives

- Utilize SE-HPLC to gather fundamental data on the hydrolysis of protein-rich byproducts.
- Select and produce peptide-rich solutions suitable for functional textiles coatings.
- Evaluate different enzymes and hydrolysis conditions using SE-HPLC.
- Repurpose protein-rich leather by-products effectively using SE-HPLC guided strategies.

Methods

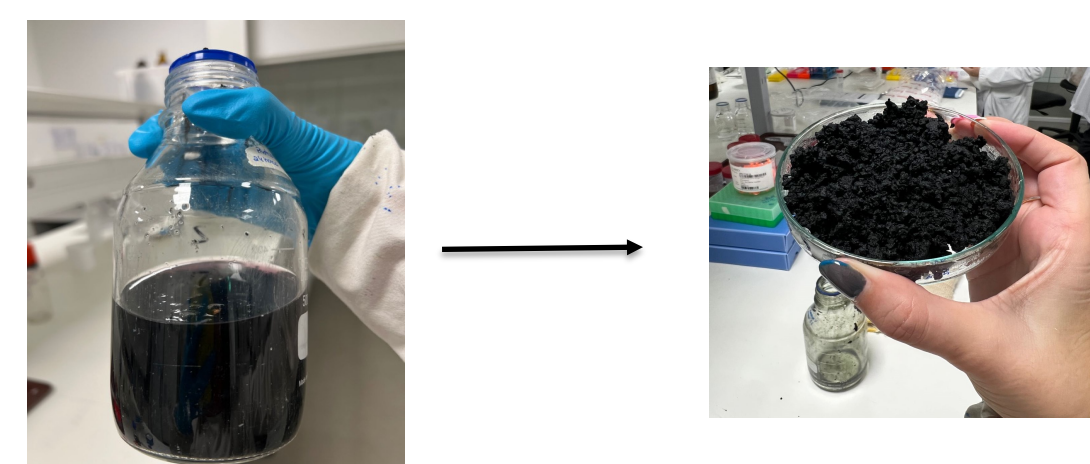
Enzymes:

Protabate P
Industrial option

Alcalase
Alternative option

Conditions:

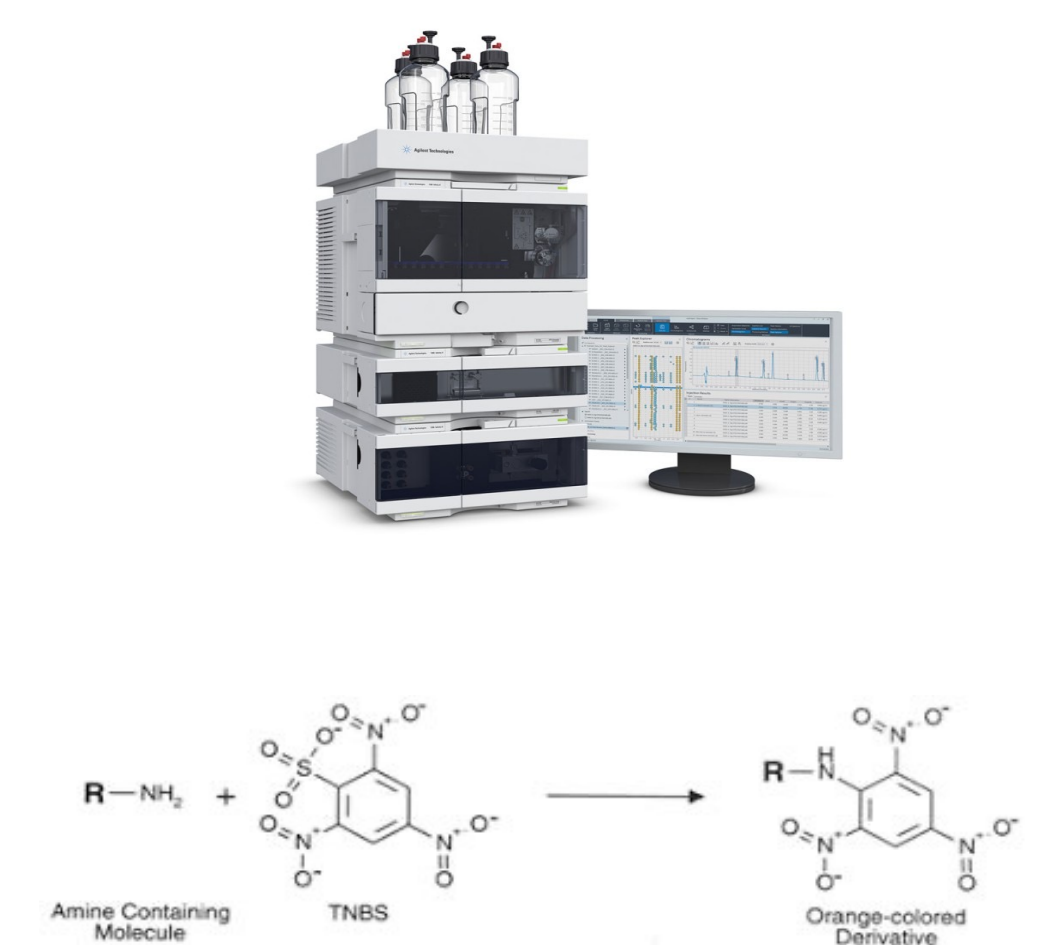
Enzyme percentage: 5 and 10%
Temperature: 37 °C
pH: 8
Hydrolysis time: 6 and 24 hours



Methodologies:

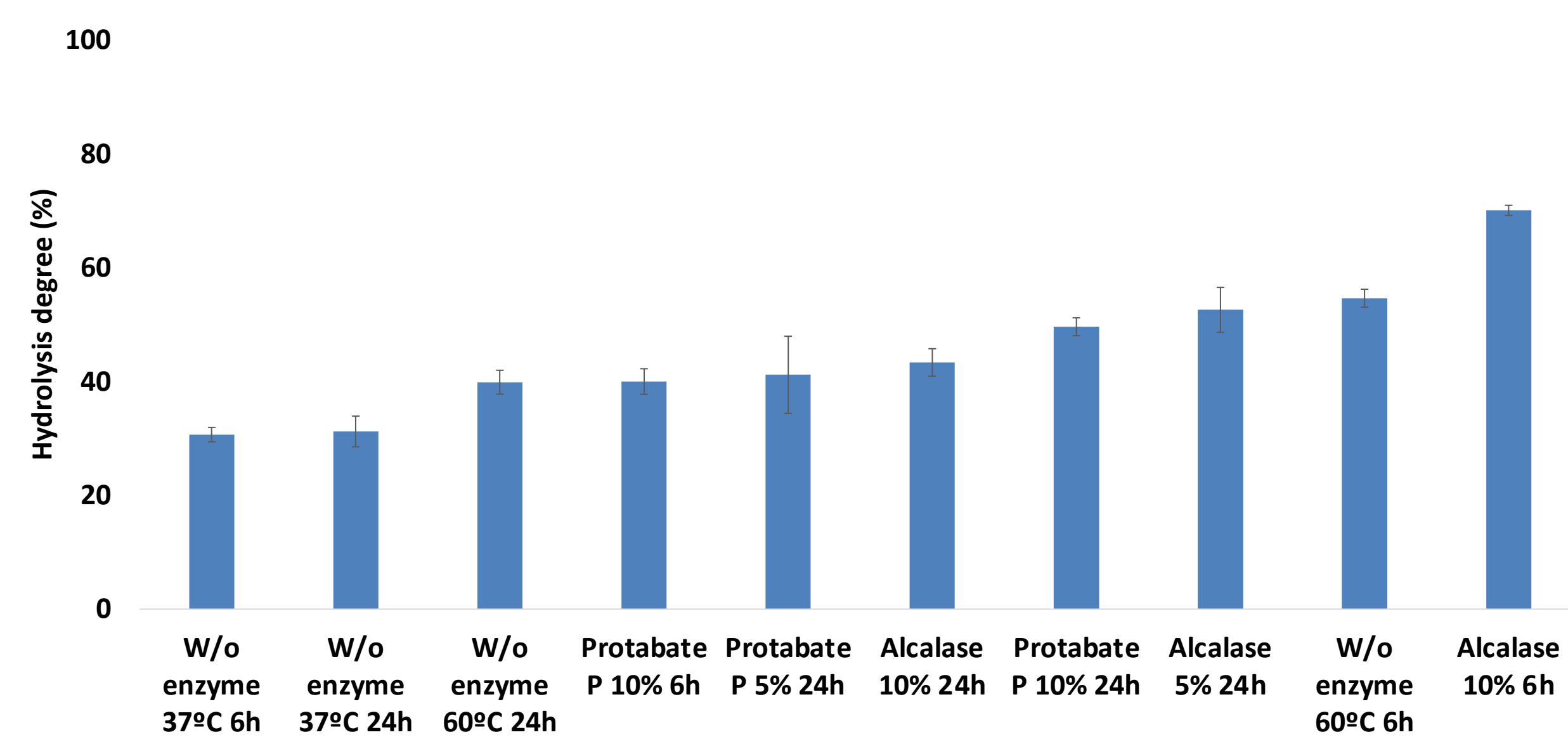
Peptide size evaluation
Size exclusion (SE-HPLC)³
employed to assess the molecular weight of peptides present within leather by-products

Hydrolysis percentage evaluation
TNBS methodology⁴

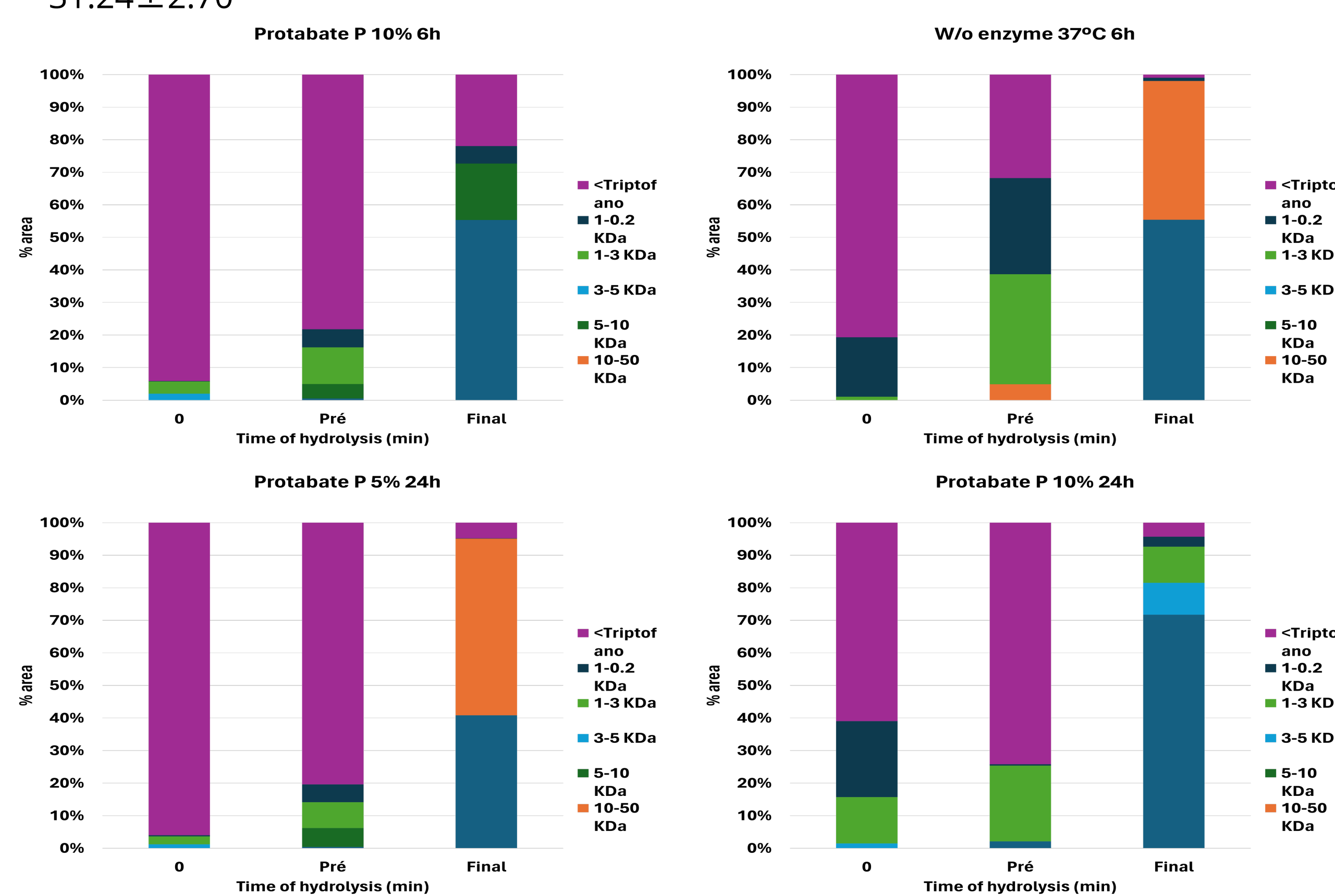


Results

TNBS



TNBS:
> Hydrolysis Degree at endpoint: Alcalase 10% for 6 hours – 70.12±0.89 %
< Hydrolysis Degree at endpoint: No enzyme 37°C for 6 and 24 hours – 30.69±1.27 and 31.24±2.70



SE-HPLC Protabate P



SE-HPLC - Alcalase

- Highest percentage at time 0 and pre-final are peptides with MW <math><0.2</math> kDa.
- At the endpoint: more peptides with MW >50 kDa and between 3 and 1 kDa.
- Alcalase 5% 24h sample has a higher percentage of peptides MW >50 kDa and between 5 and 10 kDa.

SE-HPLC – Protabate P

- Highest percentage at time 0 and pre-final of peptides with MW <math><0.2</math> kDa.
- At the endpoint peptide profile has more peptides with MW >50 kDa and between 3 and 1 kDa.
- Protabate P 5% 24h sample has a higher percentage of peptides with MW >50 kDa and between 5 and 10 kDa.

Conclusions

- Alcalase 10% 6 hours had higher hydrolysis degree (70.12%) than all the other enzymes percentage/time of hydrolysis
- Between time 0 and pre-final, molecules MW lower than 0.2 kDa consistently have a higher area.
- Conducting an enzyme inactivation (2 hours/90°C) might result in molecule aggregation, leading to an increase in molecules with MW exceeding 50 kDa.
- Utilizing this technique facilitates the identification of the optimal time/enzyme concentration ratio.
- It enables industries to repurpose waste effectively while developing new bio-based products through hydrolysis.
- Specifically, it aids in the production of functional coatings, offering a sustainable solution for waste utilization and product innovation.

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