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VALORIZATION OF HOP BIOMASS: MOLECULAR CHARACTERIZATION AND MILD HYDROTHERMAL EXTRACTION BY LACCASE-PRETREATMENT OF HEMICELLULOSE

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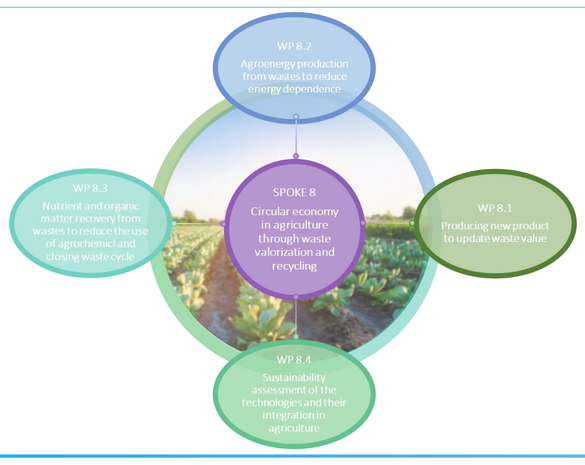
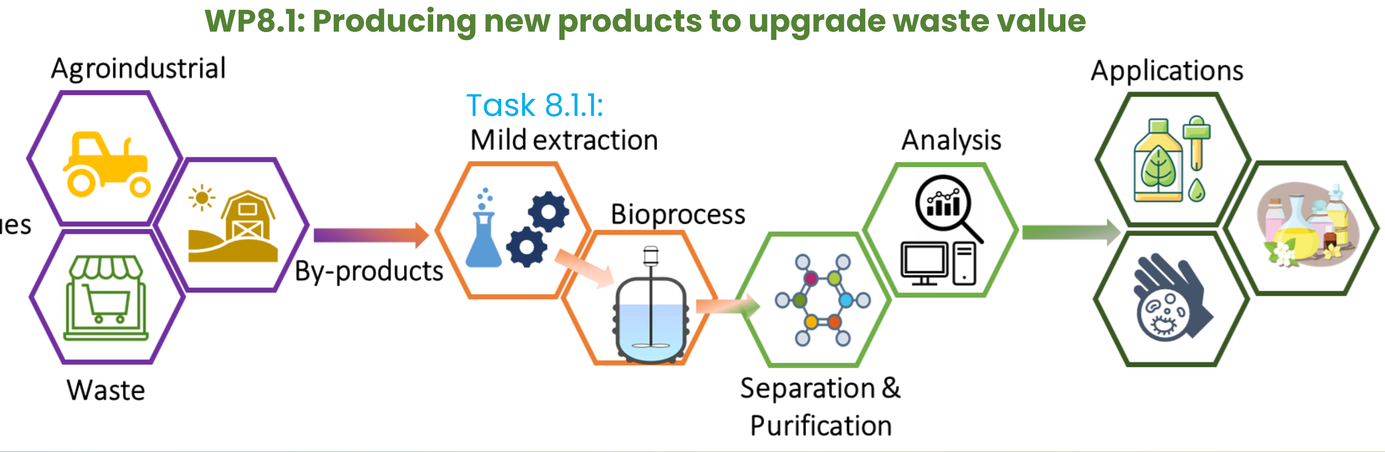




INTRODUCTION

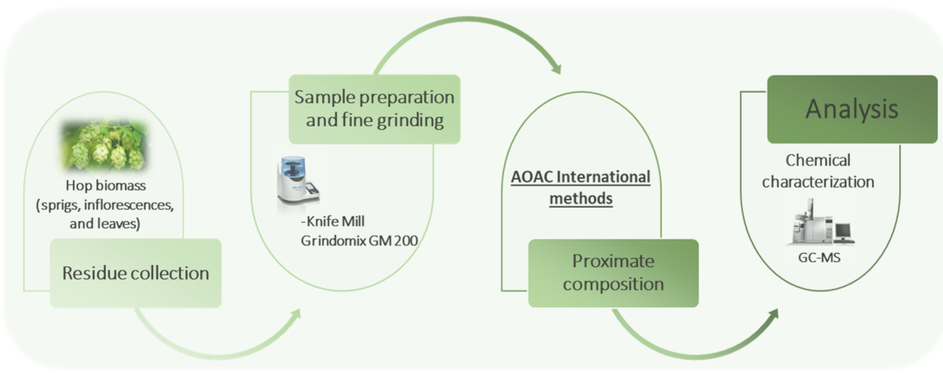
- Food industry generates huge amounts of lignocellulosic biomasses[1] → fibers sources.
- Conventional fibers extraction processes involve strong conditions: high temperature, pressures, strong acids/basis[2] → degradation compounds (not food-grade). Notably, hemicellulose was not extractable at 125°C (at least 150°C)[1].
- Multiple purification steps are required → high costs.
- Pretreatments to disrupt the vegetable matrix are needed.

Selected matrix for the study: hop sprigs, inflorescences, and leaves.

OBJECTIVES: to recover hemicellulose and other fiber fractions from lignocellulosic biomasses under mild conditions, using biotechnological pre-treatment to facilitate the degradation of the lignocellulose matrix.

METODOLOGY: the extraction protocol involve enzymatic pretreatment to disrupt the vegetable matrix. The enzyme employed is laccase from *Aspergillus sp.* Research activities include the chemical and molecular characterization using advanced techniques (GC-MS and ^{1}HNMR) before and after the extraction procedures.

EXPERIMENTAL



PROXIMATE COMPOSITION AND MOLECULAR CHARACTERIZATION of HOP BIOMASS

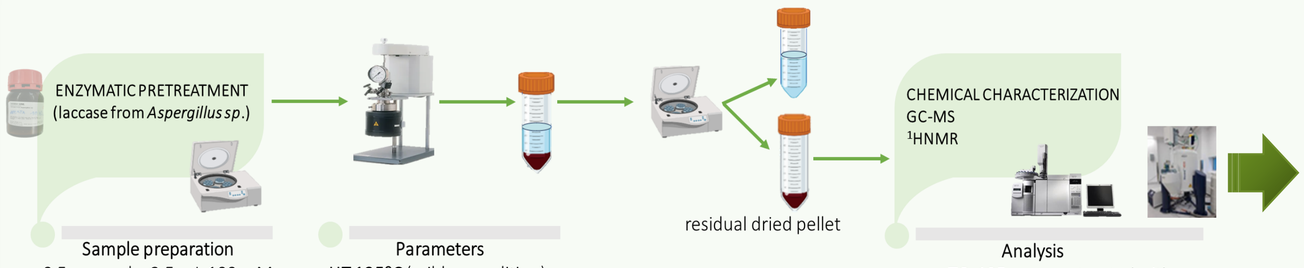
Compound	Proximate Composition(% DM)
Fat	8.8±0.2
Ash	12.4±0.2
Protein	15.2±0.2
Total dietary fibres	63.5±0.5
Insoluble fibres (IDF)	*53.2±0.9*
Soluble fibres (SDF)	*10.3±0.5*
Moisture (%)	**68.0±0.2**

The **insoluble fibres** of hop biomass is composed by lignin (72±1%), followed by 16±1% of cellulose and 12±1% of hemicellulose.

DIETARY FIBRE COMPOSITION (GC-MS)

Compounds *Monosaccharides*	SDF rel %	Hemicellulose rel %
Arabinose	7±1	19.1±0.2
Rhamnose	5.6±0.8	12.4±0.5
Ribose	0.14±0.03	-
Fucose	0.36±0.01	2.7±0.2
Xylose	1.7±0.2	20.39±0.01
Mannose	31±4	5.40±0.03
Fructose	-	-
Galactose	26±2	19±1
Glucose	13±1	17.4±0.9
Galacturonic Acid	15±1	-
Disaccharides	-	3.33±0.79

LACCASE PRETREATMENT AND HYDROTHERMAL EXTRACTION PROTOCOL OF HEMICELLULOSE



DEGRADATION COMPOUNDS AND TOTAL SUGARS (mg/g sample[1])

Sample	Acetic acid	Acetyl	Methanol	Formic acid	Lactic acid	Total sugars (as xylose)
TQ-E	3.3±0.2	1.9±0.2	1.7±0.4	1.0±0.3	7.3±0.9	44±3*
TQ-125	3.4±0.2	1.8±0.1	1.8±0.4	0.9±0.2	7±2	35±2

[1] Values are mean of three replicates.
* p< 0.05, T-test

% Acetylation		% Methylation	
TQ-E	**TQ-125**	**TQ-E**	**TQ-125**
15±3	18±1	18±3	24±5

Laccase pre-treatment, followed by HT at 125°C, significantly increased the polysaccharides extraction yields (44±3%) compared to the control at the same T°C.

FUTURE WORK AND REFERENCES

PLANNED ACTIVITIES

- GC-MS monosaccharide distribution of extracted hemicellulose (*in progress*).
- Comprehensive data elaboration in order to optimize hemicellulose extraction protocol.
- Investigation on microorganism producers of enzymes (i.e., laccase) to evaluate novel biotechnological approaches for hemicellulose degradation.

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