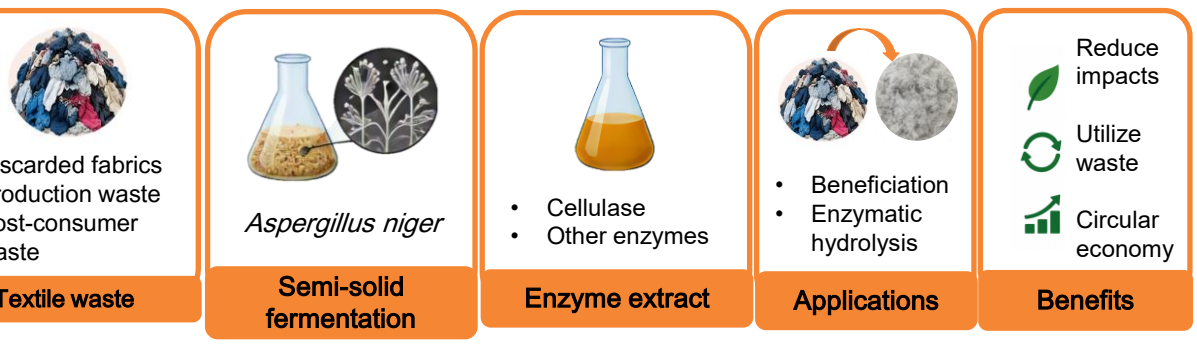
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Biotechnological utilization of textile waste to produce cellulolytic enzyme complexes: A sustainable strategy for circular bioeconomy

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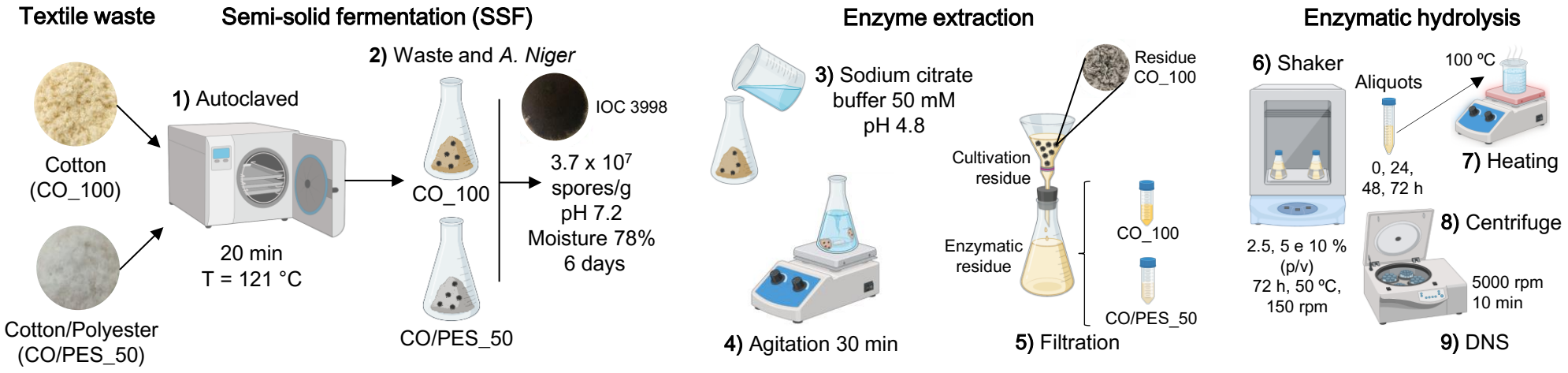
Introduction



Objective

To evaluate textile waste as a substrate to produce fungal enzymatic extracts and their application in the hydrolysis of the fermented waste itself.

Methodology



Results and discussion

In Table 1, the different processes to which the fibers were subjected, resulted in higher concentrations of available glucose after acid hydrolysis. In Table 2, CO_100 showed the highest enzyme production, with 4.03 ± 0.05 U/mL of CMCase, 0.03 ± 0.00 U mL^{-1} of FPase, and a protein concentration of 0.09 ± 0.01 mg mL^{-1}.

Table 1. Acid hydrolysis results for the residues: (A) CO_100, (B) CO_100 after SSF, (C) CO_100 after SSF and washing, and (D) after hydrolysis 10% (w/v).

Sample	Glucose (g/L)	Sample	Glucose (g/L)
A	5.45 ± 0.00	C	5.89 ± 0.16
B	2.49 ± 0.04	D	5.99 ± 0.08

Table 2. Results of the analyses performed on CO_100 and CO/PES_50 samples.

Sample	CMCase (U/mL)	FPase (U/mL)	Protein (mg/mL)
CO_100	4.03 ± 0.05	0.03 ± 0.00	0.09 ± 0.01
CO/PES_50	1.35 ± 0.01	0.01 ± 0.00	0.07 ± 0.00

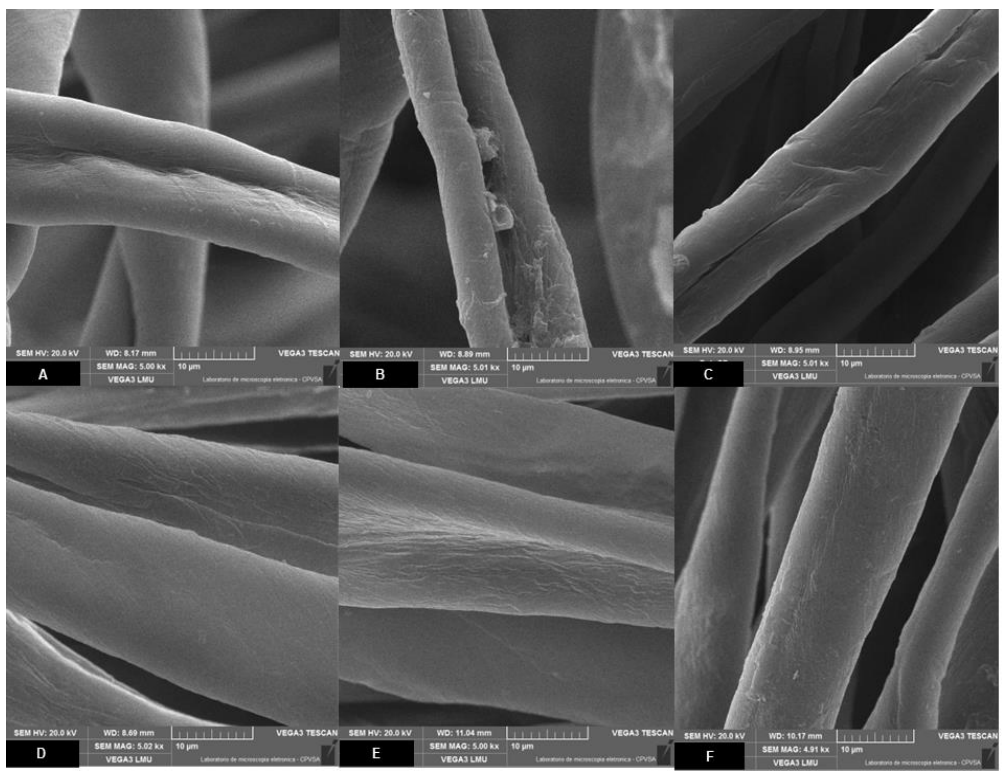


Figure 1. Scanning electron microscopy (SEM) analysis of the biomass samples: (A) CO_100, (B) CO_100 after SSF, (C) CO_100 after SSF washing, (D) CO_100 after hydrolysis at 2.5% (w/v), (E) CO_100 after hydrolysis at 5% (w/v), and (F) CO_100 after hydrolysis at 10 % (w/v).

In Figure 1, starting from sample C, cracks and slight irregularities can be observed on the cotton fiber surface. These changes may be related to the SSF, washing, and enzymatic hydrolysis processes to which the fibers were subjected.

In Graph 1, during the hydrolysis process, the CO_100 sample at 10% (w/v) also showed the best performance, reaching 0.53 ± 0.01 g L^{-1} of reducing sugars after 72 h. This value was 1.77 times higher than that obtained for CO/PES at the same solid loading.

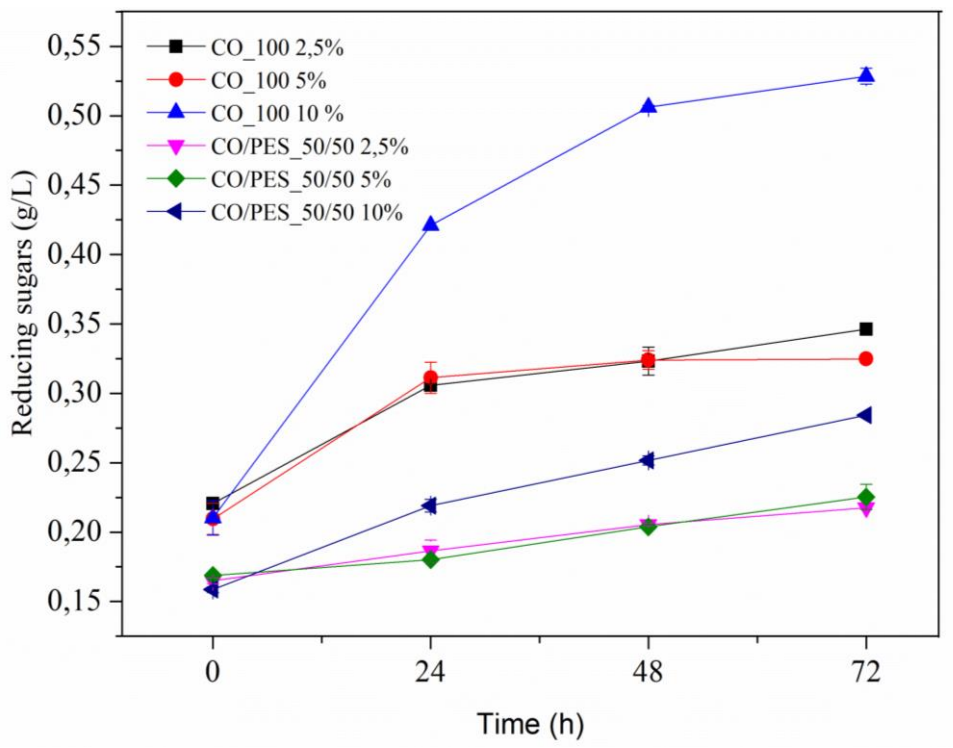


Figure 2. Enzymatic hydrolysis results for the cultivation residues of CO_100 and CO/PES_50/50 samples.

Conclusion

- ✓ Production of high-value-added bioproducts.
- ✓ Potencial for application in different biotechnological processes.
- ✓ Valorization of textile industry waste.
- ✓ Sustainable processes based on the biorefinery concept.

Acknowledgments

UFRN Universidade Federal do Rio Grande do Norte
PPGEQ
LEB Laboratório de Engenharia Bioquímica
Engenharia Têxtil
CAPES
CNPq

References