Cello-oligosaccharides from sugarcane bagasse and their emerging potential as prebiotic agents

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Introduction

Sugarcane bagasse (SCB), the major by-product of the sugarcane industry and a very promising renewable and low-cost raw material, can be used to produce valuable materials such as cellulose or cellulose-based materials, as cello-oligomers. Cellulose oligomers (cello-oligomers - COS) are functional oligosaccharides, composed by two or more β-glucose molecules linked by a β(1→4) glycosidic bond. They can be produced by chemical or enzymatic hydrolysis of cellulose and when exhibiting a low degree of polymerization (DP) from 2 to 6 glucose units, have shown promising technological and biological properties. In fact, there is evidence that when ingested, COS are not digested in small intestine, being transferred intact into the large intestine where they can be fermented, thus indicating their potential prebiotic activity.

Objectives

The aim of this study was to evaluate the potential of COS, obtained from a cellulose fraction previously extracted from SCB, through two different approaches *i.e.*, enzymatic and acid hydrolysis, on the production of lactate and short chain fatty acids (SCFA). Herein, the prebiotic potential was investigated through *in vitro* fermentation method using fecal bacteria from human donors.

Methods

The methodology and procedure used was conducted according to Carvalho et al. (2019)

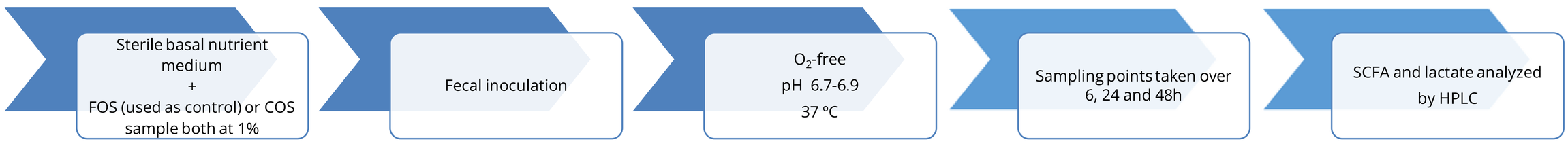

Figure 1. Schematic representation of methodology.

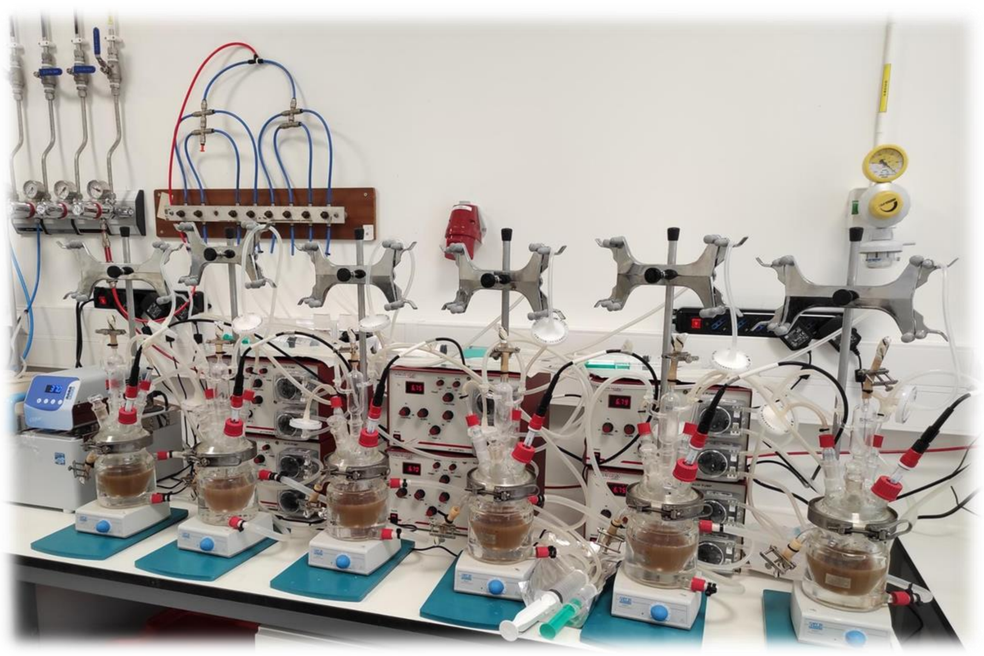

Figure 2. Setup with FerMac 260 pH controller and fermentation vessels

Results

Results showed that FOS led to a higher production of lactate within 48h compared to COS samples obtained from both enzymatic or acid hydrolysis, while COS, obtained from the enzymatic hydrolysis of cellulose, showed a higher production of acetate over 6, 24 and 48h than FOS.

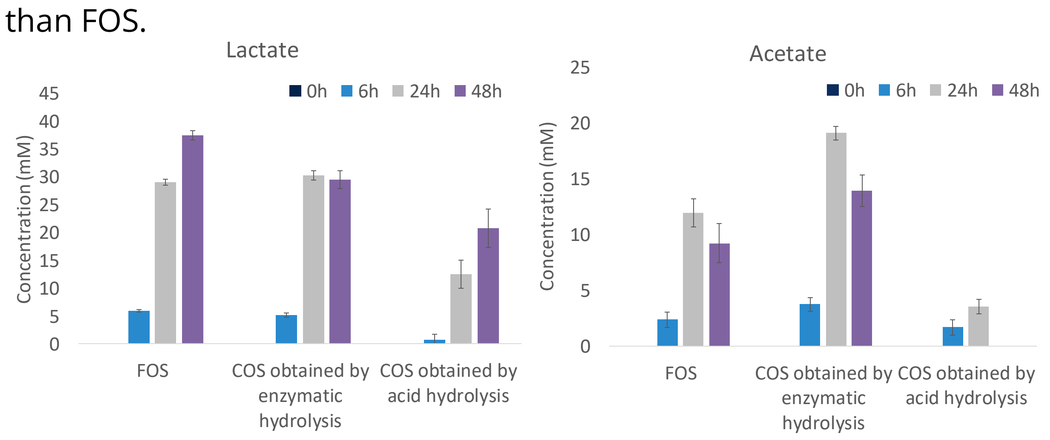

Figure 3. Concentration of lactate and acetate of samples obtained during the fermentation of FOS or COS (obtained from enzymatic hydrolysis or acid hydrolysis of cellulose previously extracted from SCB).

Conclusions

This preliminary result shows that the method used to produce COS has an impact in the promotion of acetate production. Additionally, a valuable product with prebiotic potential can be obtained from an agro-industrial residue as SCB.

Acknowledgements

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References

de Carvalho, N.M.; Walton, G.E.; Poveda, C.G.; Silva, S.N.; Amorim, M.; Madureira, A.R.; Pintado, M.E.; Gibson, G.R.; Jauregi, P. Study of *in vitro* digestion of Tenebrio molitor flour for evaluation of its impact on the human gut microbiota. *J. Funct. Foods* 2019, 59, 101–109.