Influence of culture medium growth variables on *Ganoderma lucidum* exopolysaccharides structural features

Irene Fraga [a], João Coutinho [b], Rui M. Bezerra [a], Albino A. Dias [a], Guilhermina Marques [a], Fernando M. Nunes [b]

[a]*CITAB – Centre for the Research and Technology of Agro-Environment and Biological Sciences, University of Trás-os-Montes e Alto Douro, 5001-801 Vila Real, Portugal*

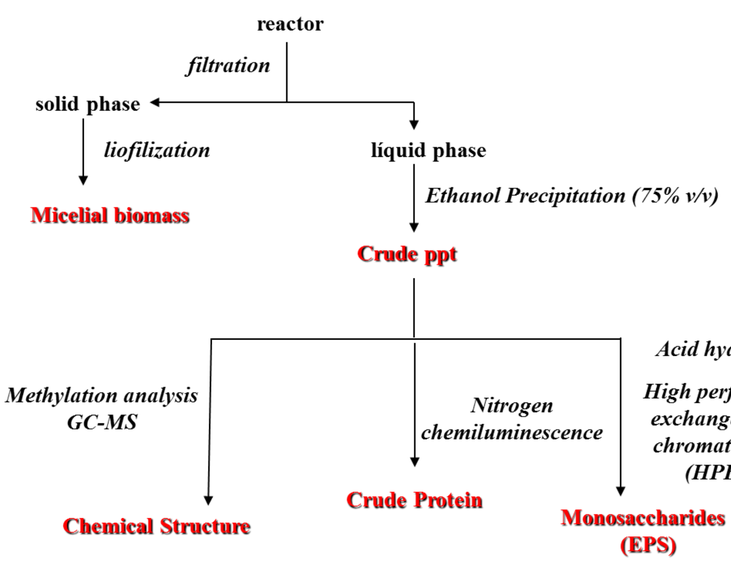
[b]*CQ – Vila Real, Chemistry Research Centre, University of Trás-os-Montes e Alto Douro, Vila Real, Portugal*

Introduction

Ganoderma lucidum has been widely used for the general promotion of health, particularly for the prevention and treatment of several types of cancer [1]. Several studies have shown that compounds isolated from this fungus presented cytotoxicity against cancer cells [2] and inhibited the growth and cancer metastases [3,4]. Therefore, *Ganoderma lucidum,* in the form of dietary supplement, can be considered as an additional therapeutic aid to cancer patients [5,1]. Furthermore, the biological activity of the polysaccharides isolated from fruiting bodies of *Ganoderma lucidum* has been linked to their structural features, for example, Miyasaki et al. [6] found that the essential structure for the antitumor activity of a branched arabinoxyloglucan from fruiting bodies is the branched glucan core involving β-(1→3), β-(1→4) and β-(1→6) linkages.

Material and methods

Scheme laboratorial analysis



Rotatable central composite design

Table 1 – Coded and experimental values

Factor	-α	-1	0	+1	+α
glucose (g L^{-1})	11.55	17.50	26.25	35.00	40.95
peptone (g L^{-1})	1.65	2.50	3.75	5.00	5.85
pH	3.32	4.00	5.00	6.00	6.68

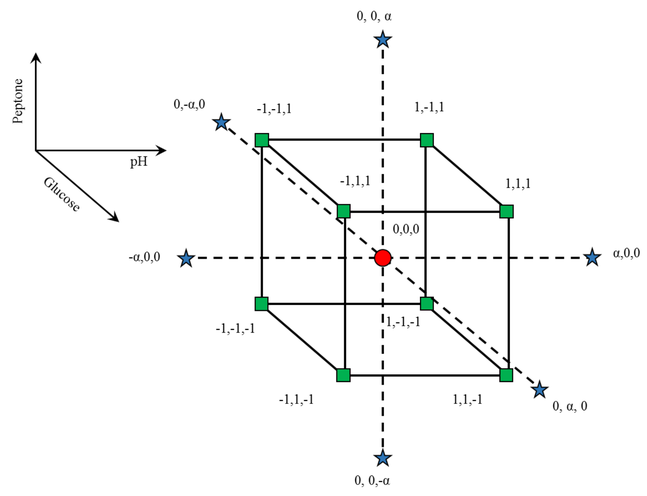


Figure 1 - Representative scheme of the applied methodology and experimental design. Factor axes are represented in coded units [9].

Results and discussion

FTIR characterization of the different EPS obtained under the different growing conditions (exemplified in figure 2) didn't show notable differences between them [9].

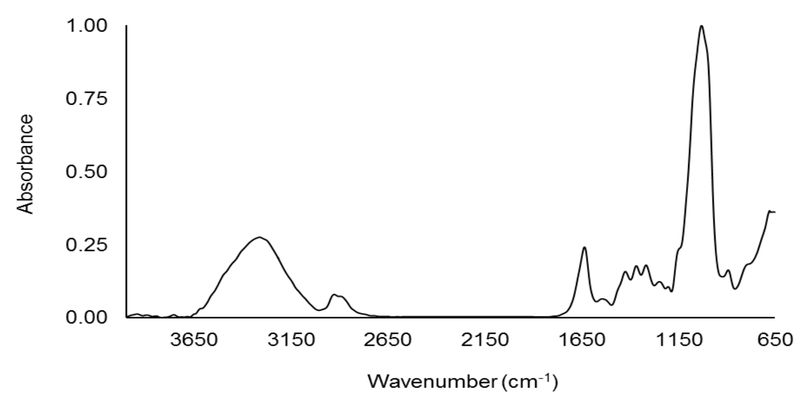


Figure 2 - FTIR spectra (4000-650 cm^{-1} region) of EPS of *Ganoderma lucidum* obtained under submerged culture conditions at the factorial point 3 (Table 1) Factor axes are represented in coded units [9].

Nevertheless, the medium culture conditions influenced significantly the branching degree of the EPS produced by *Ganoderma lucidum*, with the glucose level presenting the higher effect followed by the pH value and with a lower effect the peptone level (figure 3ABC) [9].

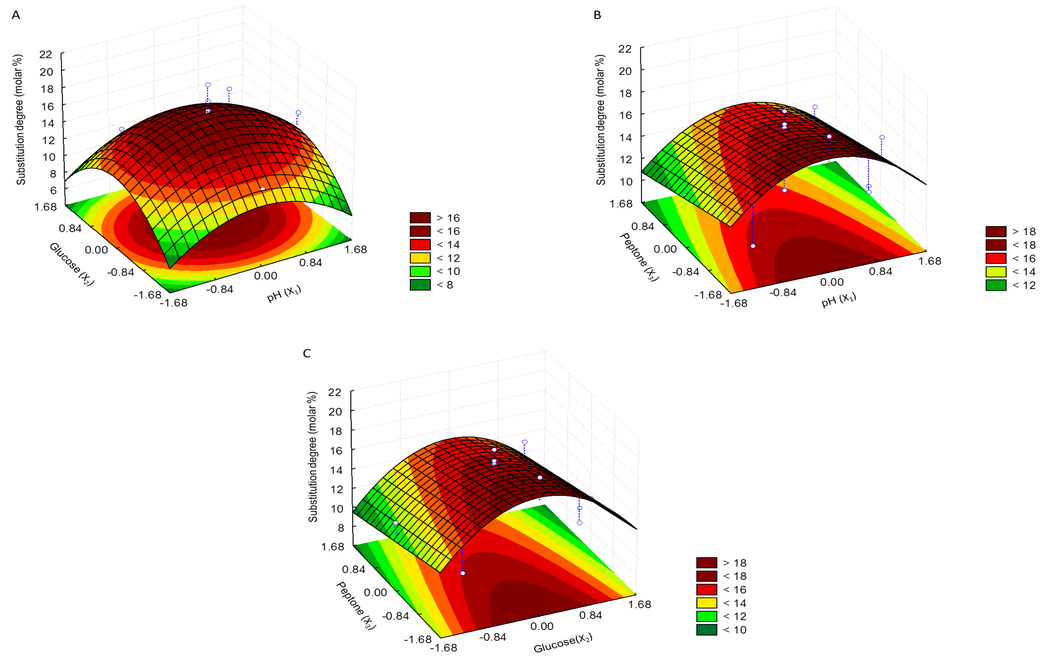


Figure 3 - Effect of pH and peptone (A), pH and glucose (B), glucose and peptone (C) on substitution degree produced by *Ganoderma lucidum.* Factor axes are represented in coded units [9].

References

[1] SP Wasser, Reishi. Encyclopedia of Dietary Supplements 2nd Edition 2010, Eds. Coates, P. M., Betz, J. M., Blackman, M. R., Cragg, G. M., Levine, M., Moss, J., White, J. D. Informa Healthcare, Chapter 78.

[2] BS Min, JJ Gao, N Nakamura, M Hattori, Chem Pharm Bull, 2000, 48, 1026-1033.

[3] Y Kimura, M Taniguchi, K Baba, Anticancer Res, 2002, 22, 3309-3318.

[4] Wasser, S. P., (2002). Appl Microbiol Biot, 60, 258-274.

[5] G Stanley, K Harvey, V Slivova, J Jiang, D Sliva, Biochem Bioph Res Co, 2005, 330, 46-52.

[6] T Miyasaki, M Nishijima, Chem Pharm Bull, 1981, 29, 3611-36-16.

[9] I Fraga, J Coutinho, RM. Bezerra, AA. Dias, G Marques, FM. Nunes, Carbohyd Polym, 2014, 111, 936-946.

Conclusions

The variability observed in the structural features dependent on the medium culture conditions can have serious implication on the biological activities of the EPS produced [9]. On the other hand, the composition of the culture medium conditions can also be used advantageously as a tool to produce tailor made polysaccharides with specific applications.

This work is supported by national funds by FCT - Portuguese Foundation for Science and Technology, under the project PEst-OE/AGR/UI4033/2014