Effects of drying technology on the physical and functional properties of mannans from *S. cerevisiae*

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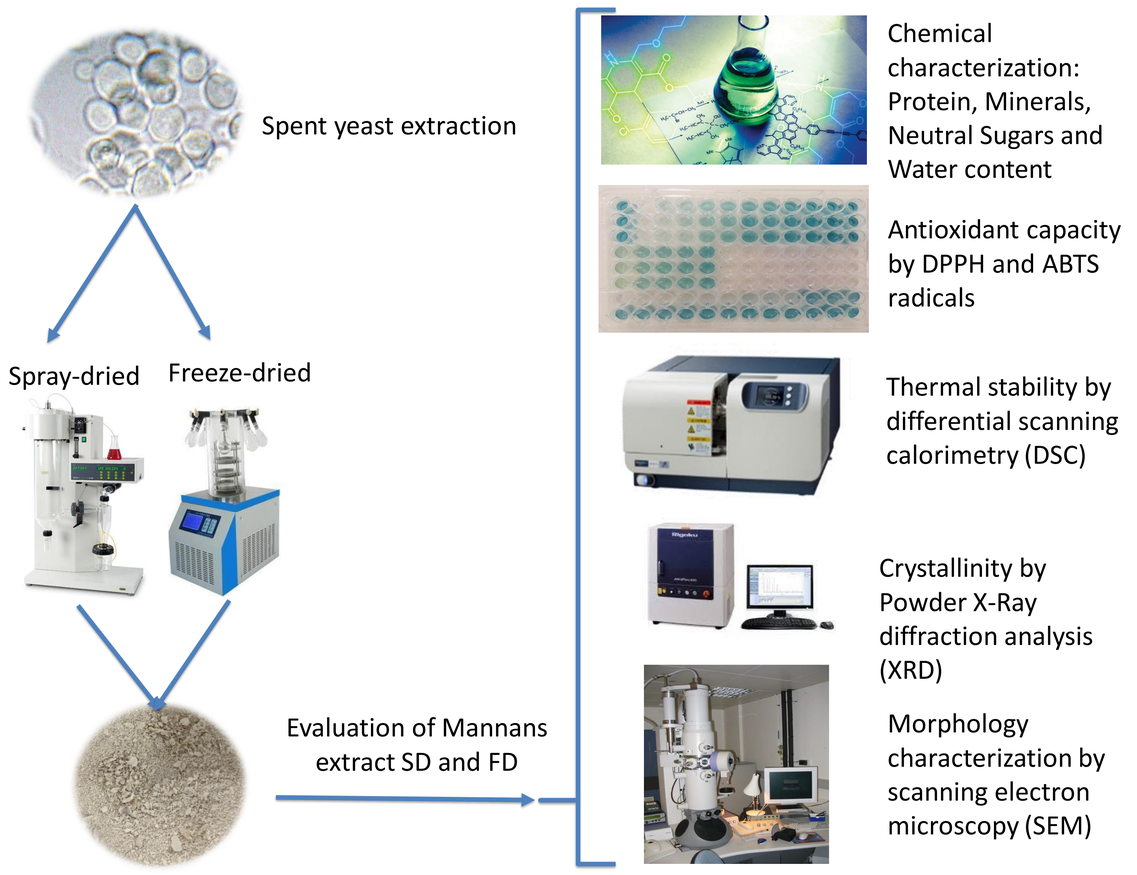
Introduction/Resume

Mannans are polysaccharides composed essentially of mannose residues, which may originate from plants or microorganisms. They can be used either as a hardener ingredient or emulsion stabilizer[1], as well as antibiotic replacers in animal feed, the later due to their capacity of inhibiting pathogen adherence and improvement of the immune response [2,3]. One source of mannans is the cell wall of *Saccharomyces cerevisiae*, which is also a waste product of many fermentation processes in the brewing and winemaking industries. The extraction of valuable components from spent yeast, such as glucans and mannans, allows its reintroduction in the production chain, thereby minimizing its environmental impact. In addition to the extraction methods employed, drying technologies may also affect several properties of the final extract and may ultimately affect its functional properties.

Objectives

In this work, mannans were extracted from the yeast cell wall and dried by two different technologies: freeze drying (FD) and spray drying (SD). The SD technology is a common technique to increase the stability and shelf life of products, while allowing for a high processing rate and possibility of scaling-up. Additionally, it is a technology with a good capacity for controlling powder/particle characteristics. The FD technology requires expensive equipment; it is a time-consuming method and may require additional processing; however, it also increases the stability of the extracts, and the lyophilized product presents much higher resistance to microorganism propagation [4].

Methods



Results

Chemical characterization

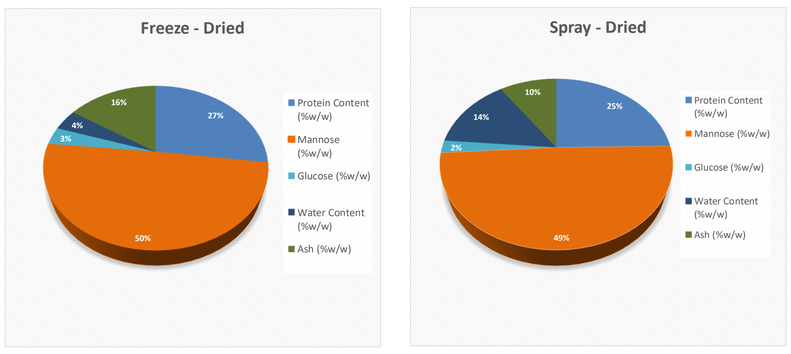


Figure 1: Chemical characterization in terms of neutral sugars, protein, mineral and water content.

Morphology

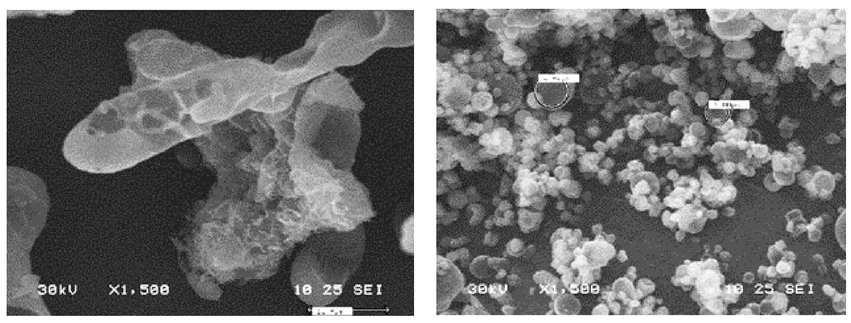


Figure 2: SEM microphotographs depicting the morphology of the same mannan extract dried by different methods, namely *via* FD (on the left) and SD (on the right), under a magnitude of 1500X.

Antioxidant capacity

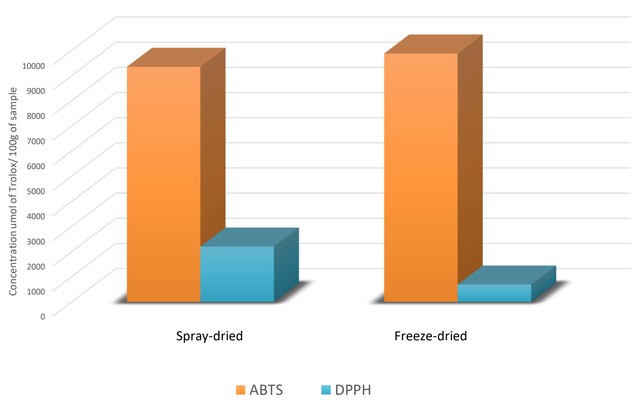


Figure 3: Results of antioxidant capacity by DPPH and ABTS free radicals

Physical Characterization

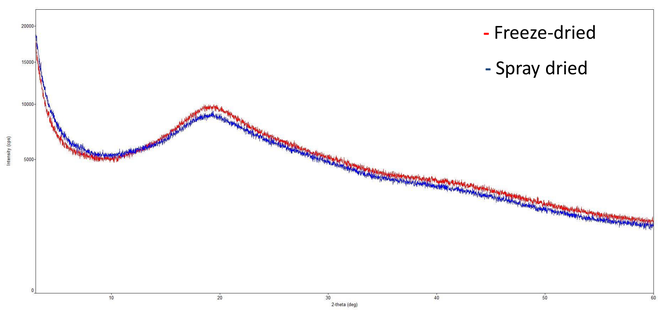
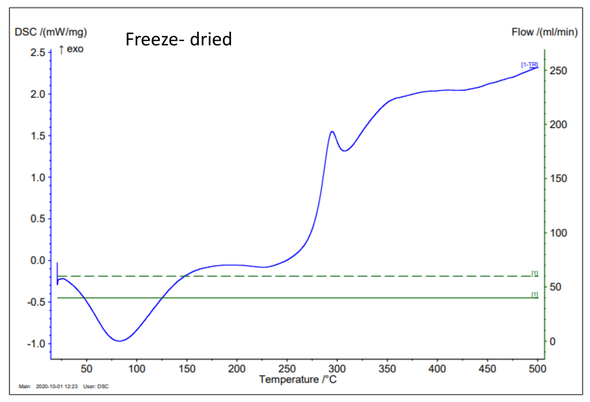


Figure 4: Results from XRD analysis



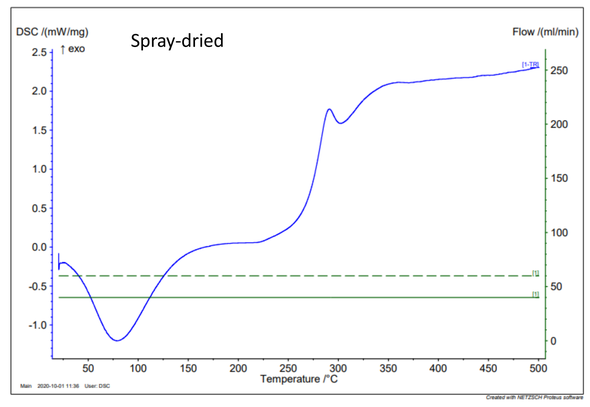


Figure 5: Results from DSC analysis

Conclusions

FD particles are very irregular in shape and significantly larger than the particles obtained by SD, which are spherical and small. In terms of physico-chemical characteristics, only the water content resulted in a significantly different value. The freeze dryer was more efficient in removing the water from the extract (4 versus 12%), when compared with the SD extract obtained. In the antioxidant activity potential, the extract that went through the spray dried process has a greater activity on the DPPH free radical (2199 µmol of Trolox/100 g of spray dried extract versus 688 µmol of Trolox/100 g of freeze-dried extract). In terms of yield, the freeze-dried process does not have so many losses, however, as mentioned above, the spray-drying method allows a greater processing rate. Additionally, the antioxidant activity of the spray dried material, using the abovementioned methodology, was shown to be improved, in comparison to the freeze-dried extract. Summing up the results obtained, SD presents itself as the preferred drying method for mannans extracts since it presented processual advantages and no detrimental effect on the biological activities measured.

References

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