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Effect of a beer bagasse dehydration process on the recovery of ferulic acid and other phenolic compounds as an alternative to agroindustrial waste revalorization

Carmen Soto-Maldonado[1], Araceli Olivares-Miralles[1], Franco Cárdenas-Fehrenberg[1]

carmensoto@creas.cl, araceliolivares@creas.cl, fcardenas@creas.cl

[1]Centro Regional de Estudios en Alimentos Saludables. Valparaíso, CHILE.

INTRODUCTION & AIM

Beer is one of the oldest drinks consumed by humans. In 2023, global production of 211.56 billion litres of this beverage was estimated. Beer production generates various wastes, bagasse being the most significant - equivalent to 31% of the raw material.

The main waste is spent barley grains, which are used as animal feed or a soil improver or disposed of in landfills. An alternative for its revaluation is the recovery of compounds with biological activity from bagasse, such as ferulic acid; however, this type of compound can be thermolabile, and processes such as dehydration can affect the amount of bioactive compounds.

This work aims to compare the recovery of total phenolic compounds (TPCs), especially ferulic acid (FA), after applying different dehydration conditions to Stout-type and Session IPA-type brewing bagasse.

METHOD

Bagasse samples were dehydrated by freeze dryer technique (Fig.1) and traditional convective process (Fig. 2). In the latter, two temperatures (60 and 80°C) were evaluated.

Figure 1. Freeze dryer

Figure 2. Convective oven.

Dehydrated samples were chemically hydrolysed to determined the total content of phenolic compounds (TPC) and ferulic acid (FA). TPCs and FA were determined via Folin–Ciocalteu and HPLC methods (Fig.3).

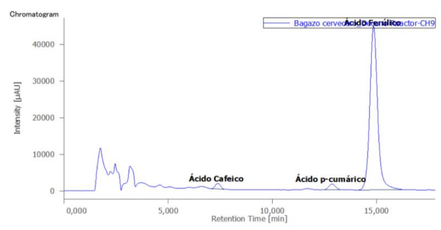
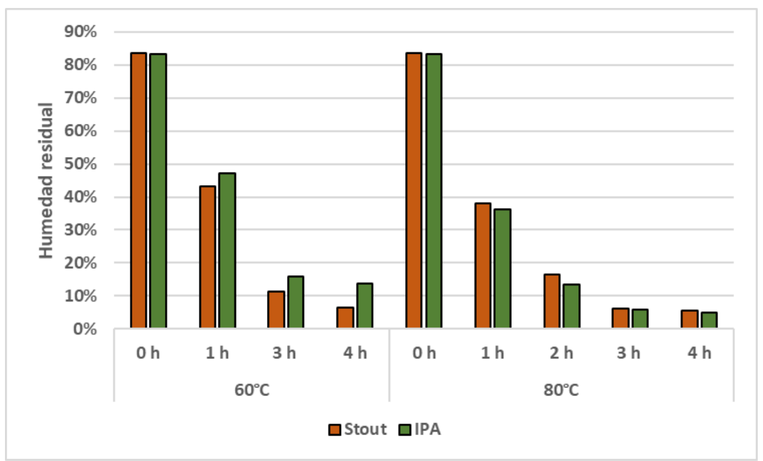


Figure 3. Chromatogram and HPLC equipment.

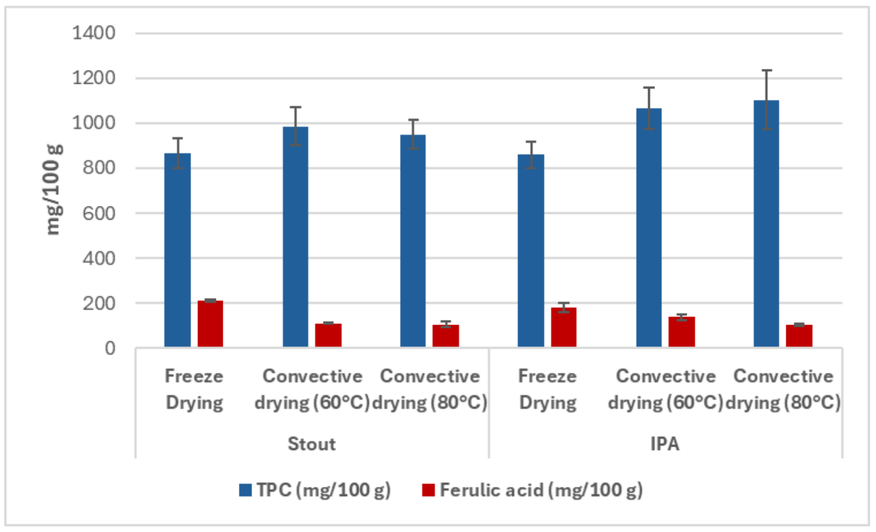
RESULTS & DISCUSSION



Figue 4: Beer bagasse drying kinetics.

Figure 4 shows the convective drying kinetics of the beer bagasse samples. As expected, samples with lower residual moisture are obtained at the highest temperature, but in both cases, it is less than 15%.

Figure 5 shows no significant differences in the presence of TPCs and AF for the Stout matter between samples dried at 60°C and 80°C in the convective process. In the case of the Session IPA bagasse, a decrease in the presence of FA is observed with increasing temperature.



Figue 5: Effect of dehydration processes on TPC and FA presence in beer bagasse.

Comparing convective and freeze-drying processes, the latter produces raw materials with lower TPCs but higher FA levels, with values of up to 210 mg/100 g.

CONCLUSION

The results presented allow us to conclude that FA recovery from brewing bagasse is feasible and that the process variables have an important effect on it.

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