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OPTIMIZATION OF DRYING CONDITIONS AND SUPERCRITICAL EXTRACTION TO IMPROVE THE ANTIOXIDANT ACTIVITY OF THREE ECOTYPES OF CHILEAN HOPS *(HUMULUS LUPULUS)* THROUGH RESPONSE SURFACE METHODOLOGY

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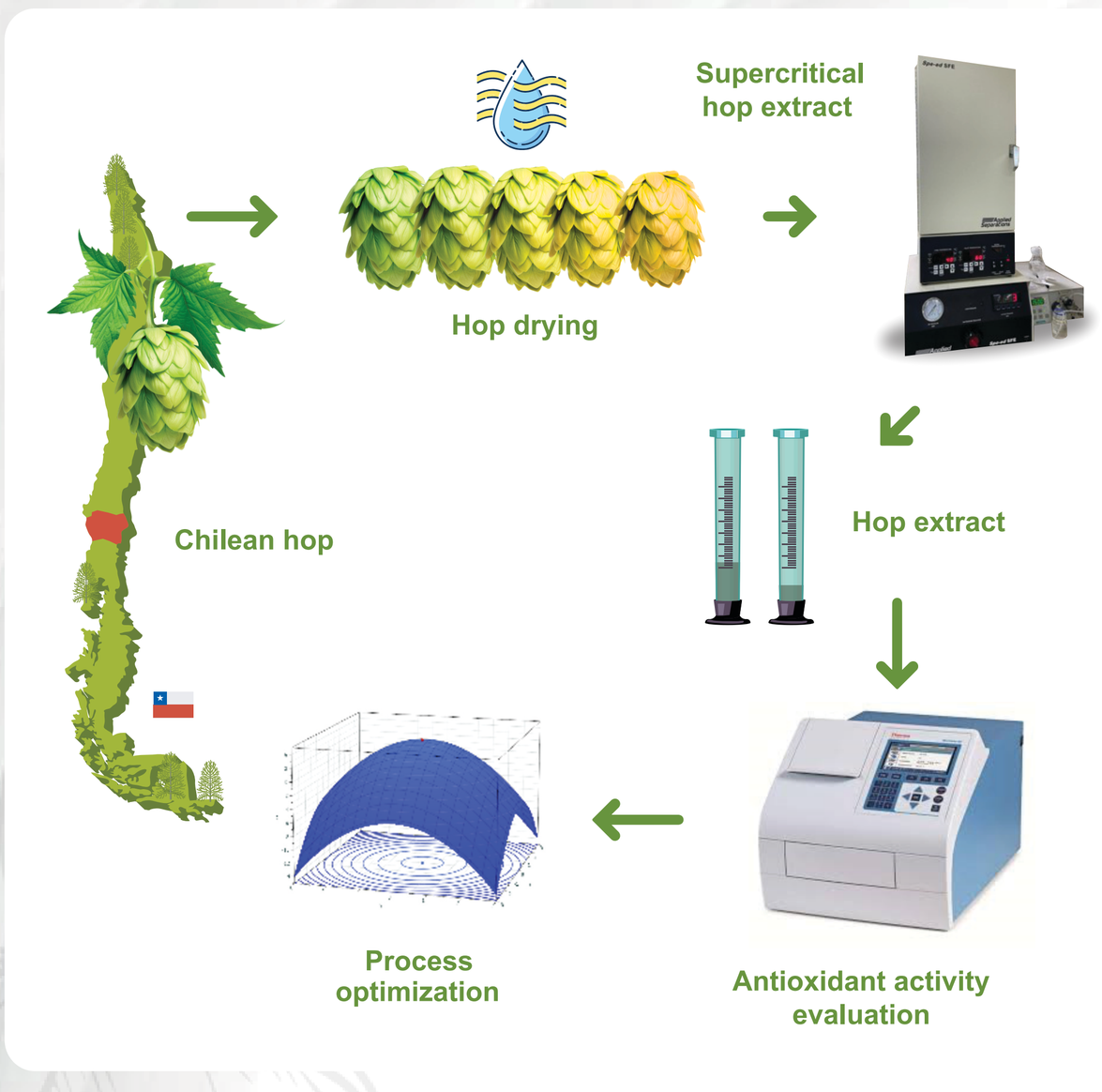
INTRODUCTION & AIM

Hops are vital for beer, contributing flavor, aroma, and stability through their resins, polyphenols, and essential oils, which possess antioxidant properties. This study explores the impact of drying conditions and supercritical extraction on the antioxidant activity of three Chilean hop ecotypes (Ranco, Valdivia, La Unión) using response surface methodology (RSM). By varying drying temperatures (50, 60, 70 °C) and extraction pressures (150, 200, 250 bar). A Box-Behnken design was employed to optimize parameters in terms of antioxidant activity using 2,2-diphenyl-1-picrylhydrazyl radical scavenging activity, and a Pareto chart was used to identify the most significant factor. The research identified optimal conditions for maximizing antioxidant activity, marking the first such optimization for these hops.

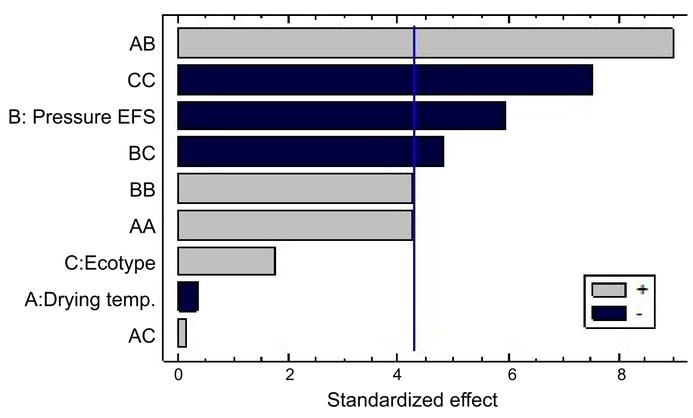


RESULTS & DISCUSSION

The optimal extraction conditions of antioxidant activity were fitted to the second order linear regression model given by:

Antioxidant activity = 91.8862-0.94175*Drying temperature-0.0844958*SFE pressure+3.19646*Ecotype+0.00547917*Drying temperature^2+0.00111* Drying temperature*SFE pressure +0.00075*Drying temperature*Ecotype+0.0000550417*SFE pressure^2-0.0029625*SFE pressure*Ecotype -0.242396*Ecotype^2.

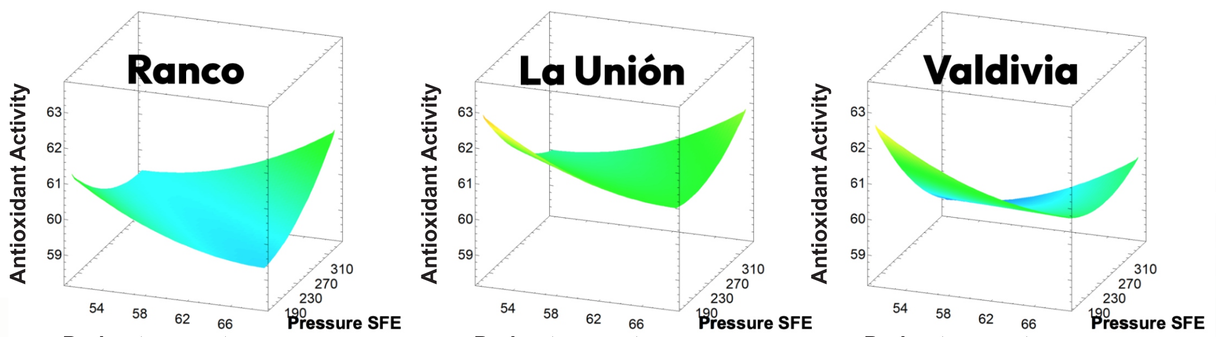
The Pareto chart (Fig. 1) shows that pressure was the most significant factor affecting antioxidant activity in the studied hop ecotypes, negatively impacting it. Increased extraction pressure led to reduced antioxidant activity, with a positive effect only when combined with temperature and, to a lesser extent, with the hop ecotypes.



Runs	Drying temperature (°C)	Pressure (bar)	Ecotype	Antioxidant Activity (% inhibition)
1	60	250	5	60,78 ± 3,10
2	50	250	7	58,53 ± 0,78
3	60	350	3	58,77 ± 3,19
4	60	150	7	62,61 ± 2,93
5	60	150	3	59,14 ± 0,09
6	50	250	3	60,23 ± 2,67
7	60	350	7	59,87 ± 3,01
8	60	250	5	60,29 ± 0,86
9	70	250	7	59,99 ± 3,36
10	50	150	5	63,76 ± 0,43
11	70	150	5	59,99 ± 2,50
12	70	250	3	61,63 ± 0,34
13	50	350	5	61,02 ± 2,76
14	70	350	5	61,69 ± 2,50
15	60	250	5	60,48 ± 1,29

* The values of the ecotype varieties correspond to an indicator variableand are represented as follows: Ranco (R): 3, La Unión (U): 5 and Valdivia (V): 7.

The La Unión ecotype in run 10 showed notable antioxidant capacity, with all ecotypes exhibiting high activity compared to other studies [1], attributed to their high phenolic compound concentrations. However, increasing temperature led to a thermosensitive degradation of antioxidant capacity in the hop samples.



CONCLUSION

*The optimized process that showed the best antioxidant activity was from the La Unión ecotype, dried at 50°C and extracted under supercritical conditions at 150 bar, indicating that temperature and pressure can positively influence antioxidant capacity.

* The extracts from Chilean hop ecotypes have significant potential for use in the pharmaceutical and food industries, warranting further detailed studies.

FUTURE WORK

In the future, it is expected to provide added value to some of the Chilean hop ecotypes in their applications in the food industry, allowing the offering of edible protective packaging or films with functional and antioxidant properties, which also allow for extending the shelf life, quality and safety of food.

Acknowlegments:

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References:

Kowalska, G., Bouchentouf, S., Kowalski, R., Wyrostek, J., Pankiewicz, U., Mazurek, A., Sujka, M., & Włodarczyk-Stasiak, M. (2022). The hop cones (Humulus lupulus L.): Chemical composition, antioxidant properties and molecular docking simulations. *Journal of Herbal Medicine*, *33*. https://doi.org/10.1016/j.hermed.2022.100566