

Use of *Chenopodium pallidicaule* grains to obtain a novel flour fermented by *Monascus ruber* in solid-state fermentation

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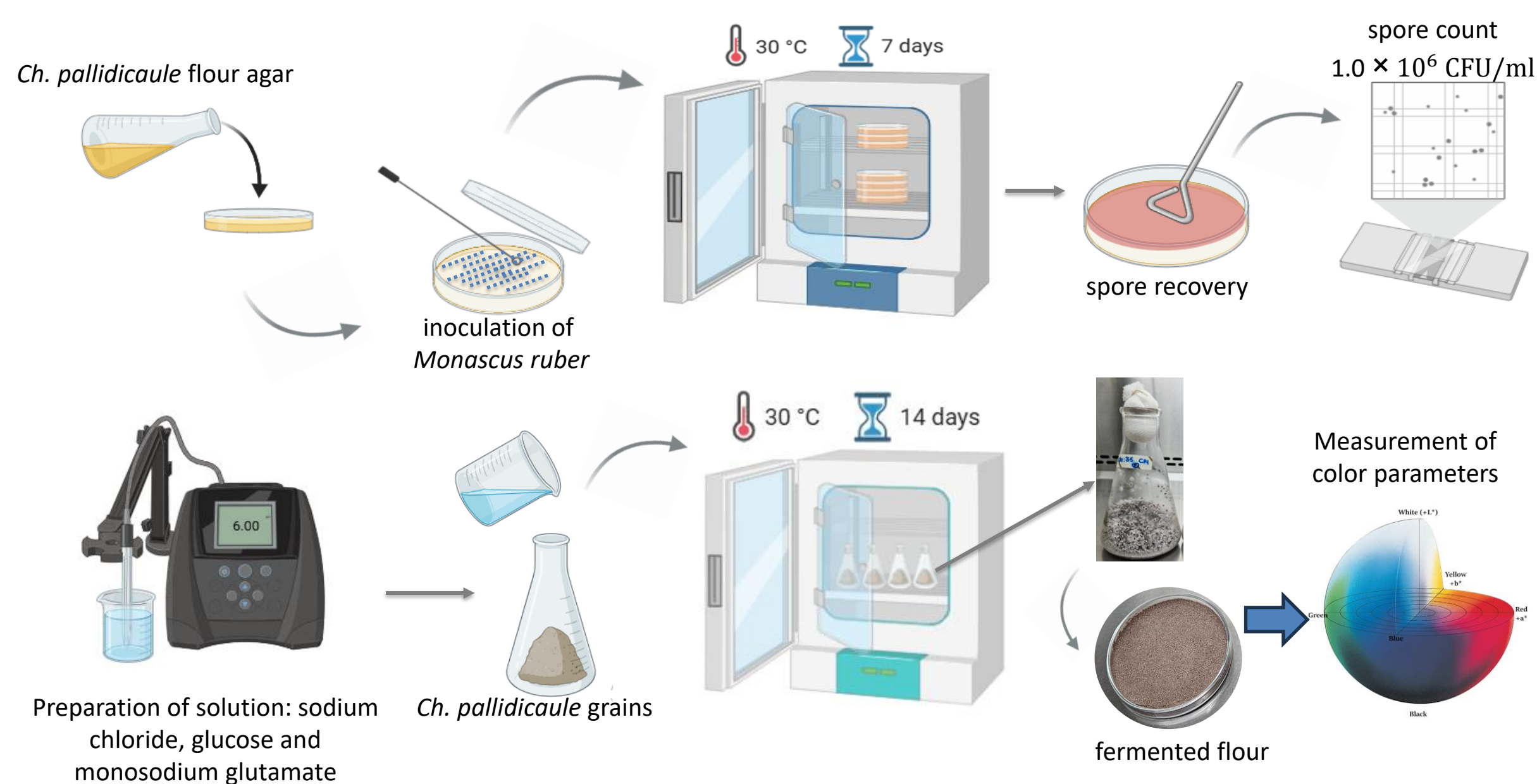
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INTRODUCTION & AIM

In the development of research, products, and especially industrial applications, more sustainable processes are being achieved. Microorganisms are used for this purpose, and an alternative is filamentous fungi that produce biopigments (red, orange, and yellow), such as the genus *Monascus*, which is capable of metabolizing cereals, providing added value through solid-state fermentation [1]. Andean grains such as *Chenopodium pallidicaule* have high biological and nutritional value and also contain peptides with antimicrobial, antioxidant, antidiabetic, and antihypertensive properties. Therefore, *Ch. pallidicaule* has great potential in industry, but it is very little researched [2]. Therefore, in this novel study, *Ch. pallidicaule* flour was obtained from the solid-state fermentation of the grains by *M. ruber*.

METHOD



RESULTS

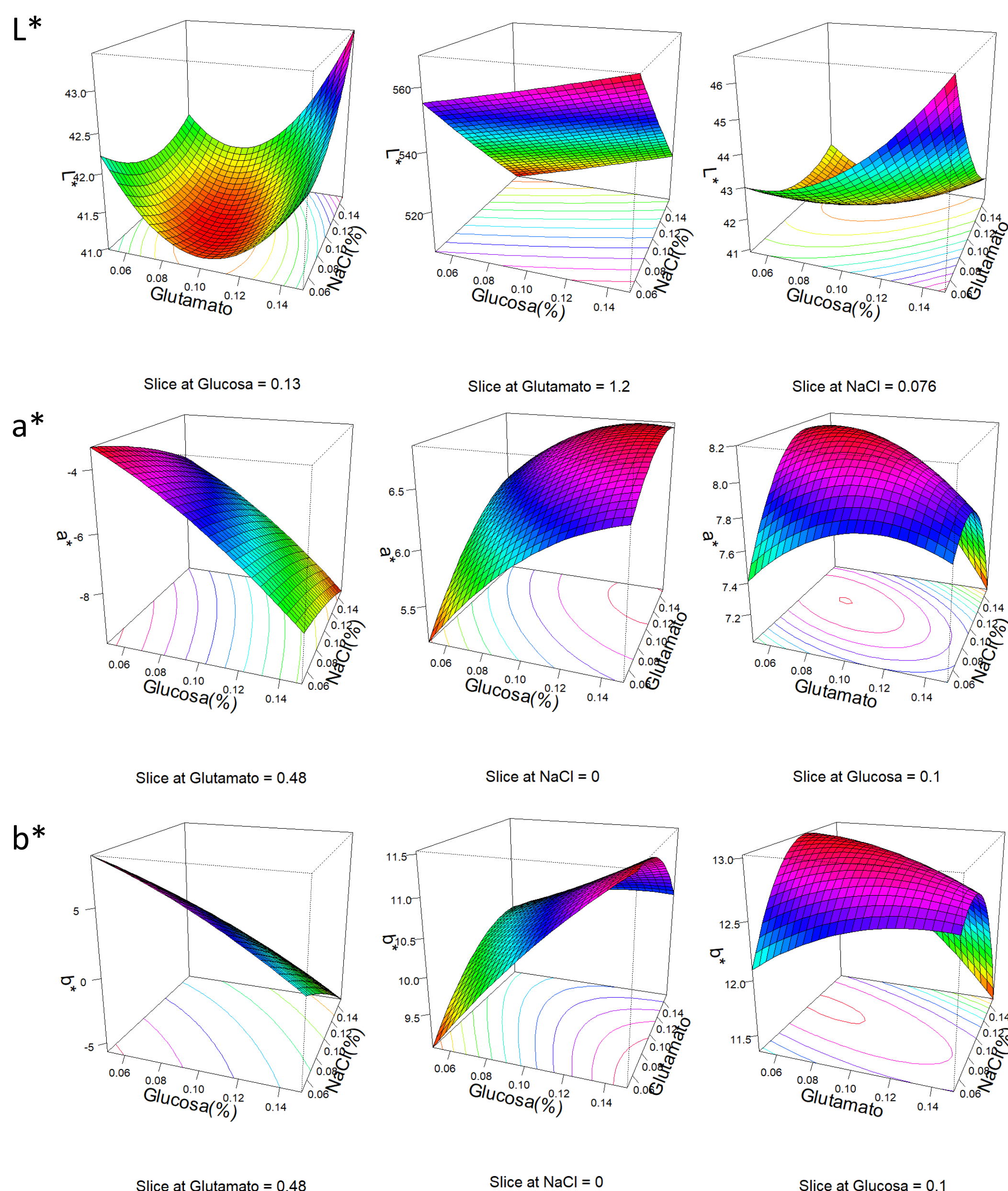


Figure 1. Response surface graphs of the three factors (sodium chloride, glucose and ratio)

Table 1. Values of the three levels of each factor in the BBD for the optimization of red kañihua flour fermented by *M. ruber*.

Factor	Real values		
	Low level	Intermediate level	High level
Sodium chloride (g/g) (X ₁)	0.05	0.10	0.15
Glucose (X ₂)	0.05	0.10	0.15
Monosodium glutamate (g/g) (X ₃)	1.0	1.2	1.4

CONCLUSION

From this research it is deduced that the Box-Behnken Design with 15 treatments allowed the optimization of the response variable a* on day 14 which was 8.53, with optimal values of the factors 0.12 g/g, 0.15 g/g and 0.05 g/g for sodium chloride, glucose and monosodium glutamate respectively.

REFERENCES

- [1] Arruda, G. L., Reis, W. S., Raymundo, M. T. F., Shibukawa, V. P., Cruz-Santos, M. M., Silos, N. O., ... & Santos, J. C. (2025). Biotechnological potential of *Monascus*: biological aspects, metabolites of interest, and opportunities for new products. Microbiological Research, 128177.
- [2] Moscoso-Mujica, G., Mujica, Á., Chura, E., Begazo, N., Jayo-Silva, K., & Oliva, M. (2024). Kañihua (*Chenopodium pallidicaule* Aellen), an ancestral Inca seed and optimal functional food and nutraceutical for the industry. Heliyon.

ACKNOWLEDGMENTS

This work was funded by CONCYTEC-PROCIENCIA [contract PE501086774-2024-PROCIENCIA].

