# Optimization of pigments extraction from quinoa flour fermented by *Monascus purpureus* supplemented with fish hydrolysate and sodium chloride

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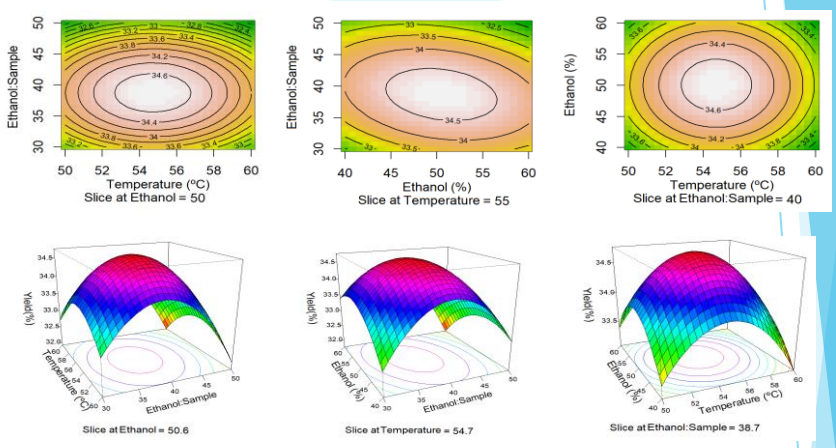
## INTRODUCTION

*Monascus purpureus* has an important use in Asian gastronomy for producing red color pigments as well as important metabolites. This fungus has been tested with different matrices in solid state fermentation, and has had a different behavior depending on the added nitrogen source. Fish hydrolysate is a rich source of free amino acids, which could lead to an improvement in pigment production. Therefore, the objective of this study is to optimize the ethanol extraction conditions for the fermentate product in order to maximise the yield, by using a response surface design.

## METHODS

Quinoa grains were fermented with *Monascus purpureus* supplemented with 1.0% fish hydrolysate and 0.5% sodium chloride; and incubated for eight days at 30ºC. The extraction parameters evaluated were: ethanol graduation (40, 50, 60º), extraction temperature (50, 55, 60ºC) and ethanol:sample ratio (30:1, 40:1, 50:1 v/w).

## RESULTS




**(a)** **(b)** **(c)**

**Figure 1.** Contour and response surface plots showing the effect of ethanol graduation (%), Temperature (ºC) and ethanol:sample ratio (ml/g) on the pigment extraction yield of fermented quinoa flour with sodium chloride and fish hydrolysate nitrogen source.

**Table 1.** Mean yield of hydroethanolic extracts produced in a BBD for three factors: Ethanol (%), Temperature (°C), Ethanol:Sample ratio (ml:g) for the pigment extraction from quinoa flour fermented by *Monascus purpureus* supplemented with fish hydrolysate and sodium chloride.

| Run Order | Ethanol (%) | Temperature (°C) | Ethanol: Sample (ml/g) | Yield |
|---|---|---|---|---|
| 1 | 60 | 50 | 40 | 33.9 ± 0.14 |
| 2 | 50 | 55 | 40 | 34.7 ± 0.18 |
| 3 | 40 | 50 | 40 | 33.2 ± 0.15 |
| 4 | 40 | 55 | 50 | 33.2 ± 0.33 |
| 5 | 40 | 60 | 40 | 32.8 ± 0.09 |
| 6 | 50 | 55 | 40 | 34.7 ± 0.18 |
| 7 | 60 | 55 | 50 | 32.0 ± 0.31 |
| 8 | 50 | 50 | 50 | 31.4 ± 0.40 |
| 9 | 60 | 55 | 30 | 32.8 ± 0.13 |
| 10 | 40 | 55 | 30 | 32.2 ± 0.66 |
| 11 | 50 | 60 | 50 | 31.8 ± 0.16 |
| 12 | 50 | 50 | 30 | 33.1 ± 0.32 |
| 13 | 60 | 60 | 40 | 32.9 ± 0.33 |
| 14 | 50 | 60 | 30 | 33.3 ± 0.32 |

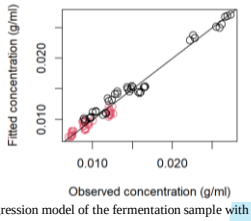



**Figure 2.** Linear regression model of the fermentation sample with salt and nitrogen source.

Under the optimized conditions (ethanol graduation 50.6º, extraction temperature 54.7ºC and ethanol: sample ratio of 38.7) the extraction yield (%) was 34.7 ± 0.18 In addition, the best equation to predict extract concentration was linear and was attained by adding up absorbances measured at 400, 470 and 500 nm at a dilution of 1:6 (R2=0.974).

## CONCLUSION

This study helped determine the optimal conditions for the hydroethanol extraction of pigments from quinoa flour fermented by *M. purpureus* supplemented with fish hydrolisate. In addition, a very useful equation for future predictions of extract concentrations from that particular fermentate flour was derived.

## REFERENCES

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