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Optimization of fucoxanthin ultrasound-assisted extraction from *Himanthalia elongata*

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INTRODUCTION & AIM

In this work, the brown seaweed *Himanthalia elongata* was evaluated as a potentially competitive starting material for fucoxanthin extraction for different food applications, taking advantage of the well-recognized dietary and health-promoting properties of this natural ingredient.

Besides its bioactive properties, fucoxanthin deserves attention also for its natural abundance in brown seaweeds, in which it stands out as one of the most abundant carotenoids, representing as well one of the most relevant carotenoids in nature (it may comprise as much as 10% of all natural carotenoids).

In previous works, fucoxanthin was highlighted for its consistent bioactivity, which may convey therapeutic benefits (considering, for instance, the reported antidiabetic, anti-inflammatory, anti-tumor, anti-hypertensive, or antiangiogenic properties) and interesting dietary effects (in result of its antioxidant and anti-obesity activity).

Herein, response surface analysis was applied to optimize the operational conditions for the extraction of fucoxanthin from H. elongata by ultrasound-assisted extraction (UAE).

METHOD

The tested conditions were time (t: 5 to 55 min), power (P: 100 to 500 W), and temperature (T: 35 to 100 ºC), which correspond to the independent variables X_1 (t), X_2 (P), and X_3 (T), considered in the optimization process that was studied by applying the usual circumscribed central composite design with five levels for each variable.

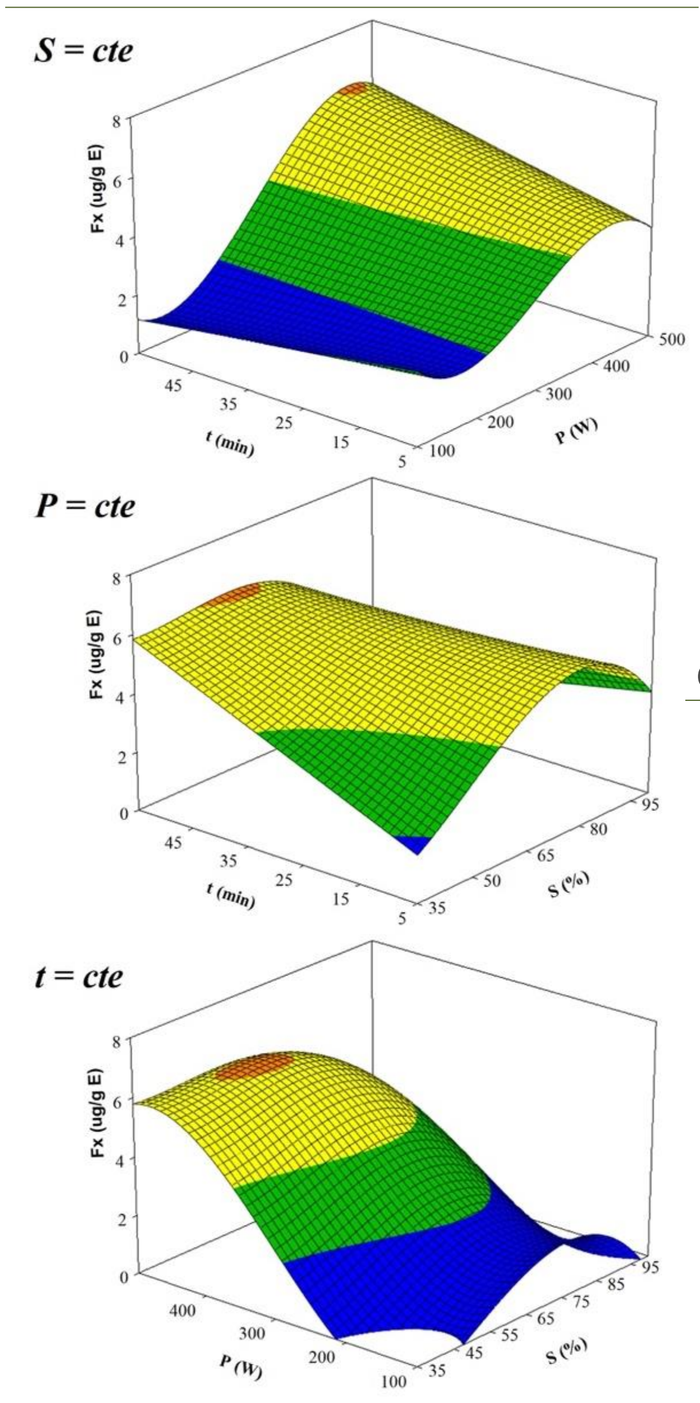
The mathematical model design provided twenty-eight combinations of outcomes: twenty-two resulting from the interaction of the selected independent variables, and six others generated from the central point.

The extraction yield and the content in fucoxanthin, quantified using a simple and short hands-on time HPLC-DAD method, were used as response variables.

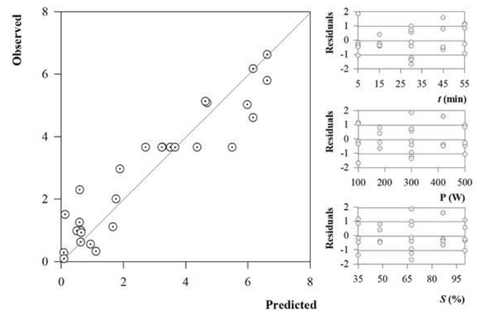
The operational conditions that maximize the level of fucoxanthin obtained through UAE were properly determined. The obtained results contribute to a sustainable and potentially profitable use of *H. elongata*, a highly abundant brown seaweed.

RESULTS & DISCUSSION

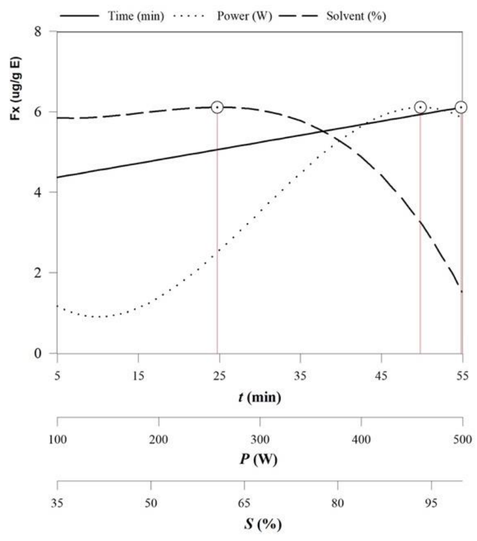
A: 3D Illustrations



B: Statistical Analysis



C: Optimal Conditions



The process of simultaneous optimization was developed using response surface methodology to find the highest possible recovery of fucoxanthin from the *H. elongata* extract.

The employed analysis prioritized the maximization of the outcomes projected by the established models.

As depicted in the figure above, the ideal conditions for MAE were identified as follows: time of 55 min (t), power of 460 W bar (P), and ethanol concentration of 61% (S).

CONCLUSION

The operational conditions that maximize the level of fucoxanthin obtained through UAE were properly determined. The obtained results contribute to a sustainable and potentially profitable use of *H. elongata*, a highly abundant brown seaweed.