Hue Knew? Media Optimization of the Orange Fungal Colorant

Authors: Flavia Meo, Jasper Meijer

Lectorate: Biobased Building Blocks & Products Research Group/Project: Smart Fermentation - TUFUCOL Contact information: f.meo@avans.nl, j.meijer8@avans.nl Date: June 12, 2025

Why Natural Colorants?

What is a Design of Experiments?

Colorants are widely used in industries like textiles and cosmetics, but concerns about synthetic dyes have driven interest into natural alternatives (Venil et al., 2020). Fungi offer a sustainable option due to their fast growth, pigment stability, and year-round availability (Lin et al., 2023). This project aims to optimize the current growth medium for improved biomass and pigment yield while reducing cost using a Design of Experiments (DoE) approach.



ANSITION

Figure 1: A test run result of Round 3 at 14 days

A DoE is an approach that systematically investigates the effects of multiple factors on a given response by using a smaller number of experiments. Five components of the medium, made up of carbon and nitrogen sources, were selected as experimental factors based on their critical role for growth and their high cost. A central composite design generated 45 test runs over 14-day incubation, consisting of a five-step process.



Figure 2: Simplified methodology consisting of inoculating, incubating, freeze-drying, ultrasonic bath, and shaker resulting in pigment extraction. Created in BioRender.

Current Results

Results from the first three rounds showed consistent fungal growth and orange pigment production (Figure 1). DoE preliminary analysis indicated NaNO₃ had no significant effect on biomass and was removed from the model. The data suggests high glucose levels consistently promote biomass yield, while malt extract can be reduced without negatively impacting growth, as can be seen in the response surface plot (Graph 1).



Graph 1: A response surface plot showing the effect of glucose and malt extract on biomass yield

Orange Color Production

The next phase involves extracting the orange pigment from the freeze-dried biomass using an ultrasonic bath followed by a shaker. Pigment yields will be compared to biomass values to determine the optimal biomass-to-pigment ratio for maximizing color production and cost-efficiency.



Figure 3: Test runs results of

Round 2 at 0 days





Figure 4: Test runs results of Round 2 at 7 days

Figure 5: Test runs results of Round 2 at 14 days

Conclusions

While these results are preliminary, they offer valuable insights. Glucose emerged as the key driver of fungal growth, providing a clear direction for medium optimization. The next steps will involve completing the final test runs and pigment extraction. These findings will lead to an optimized and cost-effective medium producing optimal biomass and pigment yield.

References

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I would like to express my sincere gratitude to my supervisor Jasper Meijer, and to Sara Finta for her

Acknowledgments

help with modeling.



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