

Optimization of *Chlorella vulgaris* cultivation grown in waste molasses syrup using mixture design

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Abstract

The aim of this study was to determine and optimize culture media for *Chlorella vulgaris* microalgae under mixotrophic conditions using waste molasses as a cheap carbon source containing both organic carbons and other nutrients. In the current study, at first the growth and lipid productivity of *Chlorella vulgaris* were assessed in different culture media and the best media was selected for mixotrophic growth conditions. Significant medium ingredients were screened through Plackett–Burman design. Then ingredients with positive effect were considered as a mixture component and their combinations were evaluated on lipid productivity using mixture design. According to results, Zarrouk medium was considered as the base medium with the highest biomass and lipid productivity of 72 and 7.1 mg/l.d , respectively. Based on the Plackett–Burman design, out of eleven factors, molasses, NaNO₃ and K₂HPO₄ demonstrated key roles in biomass and lipid productivity in mixotrophic conditions. Consequently, the selected three factors were investigated by mixture design. The results showed that high concentration of molasses causes decrease in biomass and lipid productivity due to high turbidity and a blend consisting of approximately 9.5 g/l molasses, 5 g/l NaNO₃ and 0.15 g/l K₂HPO₄ was found as the optimum mixture with obtained lipid productivity of 115 mg/l.d. In conclusion, waste molasses can be used as a promising feedstock for cost effective cultivation of *C. vulgaris*.

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