PHENOL TOLERANCE AND BIODEGRADATION OPTIMIZATION OF Serratia marcescens NSO9-1 USING PLACKETT-BURMAN AND BOX-BEHNKEN DESIGN

Nurdan Saraç1, Ayşel Uğur2, Ömer Şimşek3, Pınar Aytar4, Yagmur Toptaş4, Yeliz Buruk5, Ahmet Çabuk6*, Nimetullah Burnak5

1Mugla Sıtkı Koçman University, Faculty of Science, Department of Biology, Mugla, Turkey
2Gazi University, Faculty of Dentistry, Department of Basic Sciences, Section of Medical Microbiology, Ankara, Turkey
3Pamukkale University, Faculty of Engineering, Department of Food Engineering, Denizli, Turkey
4Eskisehir Osmangazi University, Graduate School of Natural and Applied Sciences, 26480 Eskisehir, Turkey
5Eskisehir Osmangazi University, The Faculty of Engineering and Architecture, Department of Industrial Engineering, 26480 Eskisehir, Turkey
6Eskisehir Osmangazi University, Faculty of Arts and Science, Department of Biology, 26480 Eskisehir, Turkey

Abstract

The phenol degradation capacity of Serratia marcescens NSO9-1 isolated from olive mill wastewater was evaluated and optimized in this study. Plackett-Burman design coupled with Box-Behnken methodology was used to evaluate the effects of medium components and significant parameters on phenol degradation by this relevant strain. According to Plackett-Burman-based statistical screening, seven of the eleven components of the medium had a significant effect on the metabolism of phenol degradation. The most important factors were MgSO4, NaCl, CaCl2, and molybdenum salt, which had an effective contribution of 90.12%. Additionally, Box-Behnken methodology using a quadratic model was adopted to investigate the mutual interactions between process parameters. The analysis results indicated that interactions between pH and temperature, pH and inoculum amount, and incubation time and inoculum amount critically affected the response variable. The experimental results showed that under the determined conditions, 41.66% of the maximum removal efficiency of phenol was achieved. The optimal conditions were 8.94, 30.22°C, 4.19 days, and 4.68% (v/v) for pH, temperature, incubation time, and inoculum amount, respectively. The validity and practicability of this statistical optimization strategy confirmed the relation between predicted and experimental values. Using a selective isolation method, the performance of this indigenous strain isolated from olive oil mill wastewater, which contained polyphenolic compounds, is comparable to the reported literature at higher phenol concentrations.

Keywords: Box-Behnken methodology, phenol, Plackett-Burman design, Serratia marcescens

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