

## Dosage and settling time course optimization of *Moringa oleifera* in municipal wastewater treatment using response surface methodology

Bashir Adelodun<sup>a,b</sup>, Fidelis Odedishemi Ajibade<sup>c,d</sup>, Matthew Segun Ogunshina<sup>b</sup>,  
Kyung-Sook Choi<sup>a,e,\*</sup>

<sup>a</sup>Department of Agricultural Civil Engineering, Kyungpook National University, Daegu, Korea, Tel. +821028581398/+82-53-950-5731; Fax: +82-53-950-6752; emails: ks.choi@knu.ac.kr (K.-S. Choi), adelodun.b@unilorin.edu.ng (B. Adelodun)

<sup>b</sup>Department of Agricultural and Biosystems Engineering, University of Ilorin, PMB 1515, Ilorin, Nigeria, Tel. +2348060423221; email: segunogunshina@gmail.com

<sup>c</sup>Department of Civil and Environmental Engineering, Federal University of Technology Akure, Nigeria

<sup>d</sup>University of Chinese Academy of Sciences, Beijing 100049, China, Tel. +8613126815896; email: foajibade@futa.edu.ng

<sup>e</sup>Institute of Agricultural Science & Technology, Kyungpook National University, Daegu, Korea

Received 25 November 2018; Accepted 24 June 2019

---

### ABSTRACT

The efficacy of the *Moringa oleifera* (MO) in wastewater treatment has been well studied and documented. However, there exists a significant gap in exploring the operating conditions to optimize the wastewater treatment process. This study investigated and optimized the removal efficiency of turbidity, biochemical oxygen demand (BOD), and chemical oxygen demand (COD) from municipal wastewater under the operating conditions of pH (5–7), MO dosage (50–200 mg/L), and settling time courses (60–240 min) using face-centered central composite design (FCCCD) of response surface methodology. The experimental results of FCCCD were fitted to the second-order quadratic model to approximate the effects of each variable factor and their interactions on the responses of interest in a mathematical relationship and consequently, predict the process responses. The obtained results revealed that under the optimum operating conditions of pH, MO dosage, and settling time of 6.01, 182.74 mg/L, and 228.08 min, respectively, the predicted values of turbidity, BOD, and COD removal efficiencies were 98.20%, 92.96%, and 78.82%, respectively, with the desirability of 1.000. This study demonstrated the effectiveness of FCCCD with a desirability function to optimize the process conditions (pH, MO dosage, and settling time) of coagulation for the turbidity, BOD, and COD removal efficiencies.

**Keywords:** *Moringa oleifera*; Wastewater treatment; Face-centered central composite design; RSM

---

\* Corresponding author.