

## Adsorption efficiency and isotherm of COD and NH<sub>3</sub>-N removal from stabilized leachate using natural low-cost adsorbent green mussel (*Perna viridis*)

Amir Detho<sup>a,b</sup>, Zawawi Daud<sup>b,\*</sup>, Abdulaziz Ibrahim Almohana<sup>c</sup>, Sattam Fahad Almojil<sup>c</sup>, Abdulrhman Fahmi Alali<sup>c</sup>, Asif Ali Memon<sup>a</sup>, Saleem Raza Samo<sup>a</sup>, Mohd Arif Rosli<sup>d</sup>, Halizah Awang<sup>e</sup>, Mohd Baharudin Ridzuan<sup>b</sup>, Mohamad Anuar Kamaruddin<sup>f</sup>, Azhar Abdul Halim<sup>g</sup>

<sup>a</sup>Energy & Environment Engineering Department, Quaid-e-Awam University of Engineering, Science & Technology, Nawabshah, Sindh, Pakistan, emails: amirdetho@gmail.com (A. Detho), memon.assif@gmail.com (A.A. Memon), sfaizsamo@yahoo.com (S.R. Samo)

<sup>b</sup>Faculty of Civil Engineering and Built Environment, Universiti Tun Hussein Onn Malaysia, emails: zawawi@uthm.edu.my (Z. Daud), mdbahar@uthm.edu.my (M.B. Ridzuan)

<sup>c</sup>Department of Civil Engineering, College of Engineering, King Saud University, P.O. Box: 800, Riyadh 11421, Saudi Arabia, emails: aalmohanna@ksu.edu.sa (A.I. Almohana), salmojil@ksu.edu.sa (S.F. Almojil), aalali@ksu.edu.sa (A. Fahmi Alali)

<sup>d</sup>Faculty of Engineering Technology, Universiti Tun Hussein Onn Malaysia, email: mohdarif@uthm.edu.my (M.A. Rosli)

<sup>e</sup>Faculty of Technical and Vocational Education, Universiti Tun Hussein Onn Malaysia, email: halizah@uthm.edu.my (H. Awang)

<sup>f</sup>School of Industrial Technology, Universiti Sains Malaysia, email: anuarkamaruddin@usm.my (M.A. Kamaruddin)

<sup>g</sup>School of Environmental & Natural Resources Sciences, University Kebangsaan Malaysia, email: azharhalim@ukm.edu.my (A.A. Halim)

Received 30 May 2021; Accepted 13 October 2021

---

### ABSTRACT

Landfills are an important physical facility to disposing municipal solid waste in developing countries. Although, such landfills are correlated with leachate production, which if left untreated, can pose a serious threat to human health and affect the ecosystem in the aquatic life. In the present research study, green mussel adsorbent was explored for the treatment of stabilized landfill leachate. To remove the organic constituent (COD) and ammoniacal nitrogen (NH<sub>3</sub>-N). The optimum agitation speed, pH, and adsorbent dosage were tested using particle size ranges from 2.00 mm to 3.35 mm. The physicochemical characterization was then determined. The best optimum shaking condition was determined at 200 rpm, pH and adsorbent dosages were 7 and 2.0 g. The optimum percentage removal values for COD are 40% at 200 rpm, 60% at pH 7, and 65% at 2.0 g and the optimum percentage removal values for NH<sub>3</sub>-N are 30% at 200 rpm, 50% at pH 7, and 45% at 2.0 g, respectively. Generally, the finding results revealed that the Langmuir model adsorption was slightly better fitted and suitable for organic constituent (COD) and Freundlich was good for ammoniacal nitrogen reduction in terms of coefficient of determination ( $R^2$ ). Langmuir adsorption coefficient of determination ( $R^2$ ) for COD are 0.9979 and Freundlich adsorption coefficient of determination ( $R^2$ ) for ammoniacal nitrogen are 0.9938 respectively. This implies that adsorbate adsorption occurs by monolayer adsorption on a homogeneous surface. Therefore, it is proposed that kinetic adsorption be taken into account for further research to examine the organic constituents (COD) and ammoniacal nitrogen process on to the green mussel (*Perna viridis*) media respectively.

**Keyword:** Adsorption; Ammoniacal nitrogen; Green mussel; Leachate; Organic constituent

---

\* Corresponding author.