



Biomonitoring microplastic pollution and polymer hazards using the Asian green mussel (*Perna viridis*): a baseline assessment from Santubong River, Sarawak, Malaysia

Hawa Moussa Ba · Farah Akmal Idrus

Received: 14 July 2026 / Accepted: 8 October 2026
© The Author(s), under exclusive licence to Springer Nature Switzerland AG 2026

Abstract Microplastic contamination in aquatic organisms is a growing concern due to its ubiquity and potential toxicity. Currently, data on microplastic contamination and polymer hazards in green mussels (*Perna viridis*) from the Santubong River, Sarawak, is unavailable. In this study, green mussels from the Santubong estuary were analyzed, revealing a 100% occurrence rate and a mean abundance of 5.51 items/individual. Fibers (54.7%) and fragments (30.9%) were dominant, with transparent (40.9%), white (26.1%), and blue (23.8%) being the most prevalent colors. Most particles (83.6%) were <1000 µm in size. Statistical analysis showed a moderate negative correlation ($r = -0.40$, $p < 0.05$) between microplastic abundance and soft tissue weight, suggesting potential impacts on the physiological condition of the mussels. Attenuated total reflectance Fourier-transform infrared (ATR-FTIR) spectroscopy identified polyamide (60%), polypropylene (23.3%), and polystyrene (10%) as the primary polymers. The

prevalence of polyamide is linked to local aquaculture and fishing gear, such as nylon ropes. Scanning electron microscopy (SEM) imaging confirmed extensive surface weathering, including cracks, pits, and fractures. The polymer hazard index (PHI) was calculated to be 3143.3, indicating a Level IV (high hazard) status. This study establishes a critical baseline for microplastic pollution management in *P. viridis* and environmental health assessments in Malaysian Borneo.

Keywords Microplastic contamination · *Perna viridis* · Polymer hazard · Santubong River

Introduction

Global plastic production continues to rise annually, driven by population growth, urbanization, and increasing consumer demand, resulting in a surge of plastic waste with significant consequences for marine ecosystems health and the livelihoods of coastal communities. Malaysia, for instance, records the highest annual per capita plastic consumption in Southeast Asia, at 16.78 kg per person, surpassing countries such as China, Indonesia, Philippines, Thailand, and Vietnam (WWF, 2020). This growing plastic burden is largely attributed to the excessive use of single-use plastics, inadequate waste management infrastructure, and rapid population growth. Consequently, large volumes of plastic enter rivers and

H. M. Ba · F. A. Idrus (✉)
Faculty of Resource Science and Technology, Universiti
Malaysia Sarawak (UNIMAS), 94300 Kota Samarahan,
Sarawak, Malaysia
e-mail: aifarah@unimas.my

H. M. Ba
e-mail: 24020209@siswa.unimas.my

F. A. Idrus
UNIMAS Water Centre, 94300 Kota Samarahan, Sarawak,
Malaysia