

Microplastics Determination in the Rivers with Different Urbanisation Variances: A Case Study in Kuching City, Sarawak, Malaysia

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ABSTRACT

The presence of microplastics in aquatic systems is mainly due to the anthropogenic activities such as domestic waste dumping. Undeniably, rivers either in urban or suburban areas are always a waste dumping sites from the surrounding residences. Thus, the purpose of this study was to determine the relationship between microplastic abundance and different degree of urbanization across Kuching in Sarawak. Three sampling locations with different degrees of urbanisation had been studied across Kuching. A total of 137 pieces of microplastics were collected along the study and analysed using stereoscopic microscope for the shape identification and FTIR spectrophotometer for functional groups present in the microplastics. Filament was the most abundant microplastics shape found, whereas the IR results showed that ethylenevinylacetate (9%), polyamides or nylon (15%), polypropylene (42%), poly(methylmethacrylate) (16%) and polystyrene (18%) were found in the study. The most abundant microplastics in the water samples was polypropylene (42%), whereas ethylenevinylacetate (9%) was the least. The degree of urbanisation does not directly relate to the microplastic present in the river system in Kuching City, but the anthropogenic activity is the main factor that affecting the microplastic abundance in the river.

Keywords: Anthropogenic activity, FTIR, microplastics, polymer identification, urban, sub-urban

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INTRODUCTION

The plastic manufacturing industry is one of the most dynamic and vibrant growth sectors in Malaysia. However, in line with the increase of plastic production, the plastic wastes have been recorded the third largest waste tonnage, after the putrescible waste and paper waste (Malaysian Department of Housing and Local Government, 2011).

As plastic particles can be broken into small particle called microplastics, this has prompted public concerns due to high possibility of microplastics flow into the food chain. The abundance of microplastics in aquatic environment as it is highly volatile in mobility (Ng & Obbard, 2006; Gall & Thompson, 2015; Kwon *et al.*, 2017) and ingested by aquatic organisms and gets into food chain (Yusof *et al.*, 2016; Avio *et al.*, 2017; Yusof *et al.*, 2017; Karami *et al.*, 2017; Smith *et al.*, 2018). Many researchers found that

microplastics are more abundant in subtidal sediments and sea waters rather than on sandy beaches and in estuarine habitats (Thompson *et al.*, 2004; Browne *et al.*, 2011; Claessens *et al.*, 2011; Peng *et al.*, 2018; Peng *et al.*, 2019). Thus, the sources of microplastics could origin from the rivers (Shazani *et al.*, 2018) due to irresponsible domestic wastes dumping into the rivers by surrounding communities. Again, this could be also strongly related to the human population as well as the environmental awareness of the surrounding community. Hence, this study was designed to relate the source of microplastics to different degree of urbanization across Kuching City.

MATERIALS AND METHODS

Sampling Locations and Frequencies

The river water samples were collected from three areas in Kuching City namely Kuap River (**W1**) in sub-urban area, Maong River (**W2**) located in