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Baseline

Occurrence of endocrine disrupting compounds in mariculture sediment of Pulau Kukup, Johor, Malaysia

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ABSTRACT

Endocrine-disrupting compounds (EDCs) such as hormones, pesticides, phenolic compounds, and pharmaceuticals compounds can cause adverse effects on humans, animals, and other living organisms. One of the largest mariculture areas situated in Pulau Kukup, Johor, Malaysia, is actively involved in exporting marine fish to other countries worldwide. This paper aims to provide baseline data on the level of EDC pollutants found in mariculture sediments in Malaysia since no reports have investigated this issue. Calculated samples recovered are between 50.39 and 129.10% at 100 ng/g spiking level. The highest concentration in the sediment samples was bisphenol A (0.072–0.389 ng/g dry weight) followed by diethylstilbestrol (< 0.208–0.331 ng/g dry weight) and propranolol (< 0.250–0.275 ng/g dry weight). Even though the concentrations of the targeted compounds obtained were low, their effects could become more evident longer term, which raises not only environmental health concerns but the potential risk to humans.

Endocrine-disrupting compounds (EDCs) comprise of natural and synthetic compounds that are readily discharged into the environment through household, municipal, hospital, industrial, and livestock waste (Wang et al., 2013; Aris et al., 2014; Salgueiro-González et al., 2015; Tan et al., 2018). Both natural and artificial EDCs commonly exist in the environment in the range of pg/L to ng/L (Beck et al., 2005; Hibberd et al., 2009) in the form of active ingredients found in food products and other consumer products comprising of natural and artificial hormones, medicines and pharmaceuticals, industrial and household chemicals, pesticides, alkylphenol, and plasticiser (Bartelt-Hunt et al., 2009; Kabir et al., 2015; Grześkowiak et al., 2016; Niu and Zhang, 2018; De Solla et al., 2016). Not to mention, EDCs have the ability to mimic and block the endocrine system in humans causing severe effects such as cancer, abnormal reproductive growth, and metabolic disorders (i.e. diabetes, obesity, and endometriosis), and a wide variety of problems associated with human well-being (Esteban et al., 2014; Legler et al., 2015; Giulivo et al., 2016; Ismail et al., 2018). EDCs can also disrupt various bodily functions with different pathways and mechanisms.

However, the study of EDCs in the context of the marine ecosystem is relatively scarce compared to the study of EDCs in humans, inland animals, ecological health, riverine and estuarine ecosystems (Robinson

et al., 2009; Bayen et al., 2013; Aris et al., 2014; Bayen et al., 2014; Omar et al., 2018; Wee et al., 2019). Notably, the exposure of EDCs can cause both bioaccumulation and biomagnification in the marine ecosystem, associated with potential health effects such as intersex, skewed sex ratios and reduced gonadal development and viability (Gaspard et al., 2009; Martin and Grant, 2019). The scarcity of data relating to EDCs in the marine ecosystem is mainly due to the analytical problems associated with low-quality assurance and quality control in detecting and quantifying EDCs (Beck et al., 2005). As such, given these difficulties, the knowledge regarding the occurrence, distribution, fate, and effects of these pollutants in marine environments remains a persistent issue that requires further research and investigation.

On the other hand, while there are numerous studies on EDCs found in environmental matrices, a suitable method for quantifying multi-residues of EDCs in one single execution remains inadequate (Kim and Carlson, 2005). Moreover, given sedimentation, resuspension of the bed sediment, high salinity, and high matrix effect which contains lots of various organic matter, analysis of sediment matrices from the marine ecosystem is difficult to achieve compared to that of other matrices. Even though numerous analytical procedures have been developed and optimised to measure the presence of EDCs in the environment, prior studies have only focused on analysing water samples, with less interest

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