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Quantification of multi-classes of endocrine-disrupting compounds in estuarine water

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ABSTRACT

Emerging pollutants known as endocrine-disrupting compounds (EDCs) are a contemporary global issue, especially in aquatic ecosystems. As aquaculture production through mariculture activities in Malaysia supports food production, the concentration and distribution of EDCs in estuarine water ecosystems may have changed. Therefore, this current study aims to prepare a suitable and reliable method for application on environmental samples. Besides, this study also presented the occurrence of EDCs pollutant in Pulau Kukup, Johor, where the biggest and most active mariculture site in Malaysia takes place. Analytical methods based on a combination of solid-phase extraction with liquid chromatography tandem mass spectrometry (Solid-phase extraction (SPE)-LC-MS/MS) have been modified and optimised to examine the level of targeted EDCs contaminant. In the current study, this method displays high extraction recovery for targeted EDCs, ranging from 92.02% to 132.32%. The highest concentration detected is diclofenac (<0.47–79.89 ng/L) followed by 17β-estradiol (E2) (<5.28–31.43 ng/L) and 17α-ethynylestradiol (EE2) (<0.30–7.67 ng/L). The highest percentage distribution for the targeted EDCs in the current study is diclofenac, followed by EE2 and dexamethasone with the percentages of 99.44%, 89.53% and 73.23%, respectively. This current study can be a baseline assessment to understand the pollution profile of EDCs and their distribution in the estuarine water of the mariculture site throughout the world, especially in Malaysia. Owing to the significant concentration of targeted EDCs detected in water samples, the need for further monitoring in the future is required.

Main finding:

Multi-classes of endocrine-disrupting compounds (EDCs) were examined in estuarine water samples from Pulau Kukup, Johor, Malaysia based on a combination of solid phase extraction and liquid chromatography-tandem mass spectrometry (SPE-LC-MS/MS).

1. Introduction

The occurrence of organic compounds in the environment known as endocrine-disrupting compounds (EDCs) has the potential to elicit negative impacts on the hormonal systems of organisms (Campbell et al., 2006; Deblonde et al., 2011; Bayen et al., 2013; Aris et al., 2014). This issue has aroused great interest over the past decades due to the industrial and domestic applications of EDCs. EDCs can be grouped into natural or synthetic compounds and were produced by industrial waste, agriculture, aquaculture, pharmaceutical waste and urban activities (Esteban et al., 2014a; Barreiros et al., 2016). These organic pollutants can exert their effect by altering and mimicking the actions of hormones in any stage of a living organism, from foetal development to adulthood (Mills & Chichester, 2005; Esteban et al., 2014b; Kabir et al., 2015; Giulivo et al., 2016; Ismail et al., 2018).

Owing to the low concentration (μg/L or ng/L) of EDCs found in the environment, highly sensitive analytical procedures are needed to identify and quantify these low environmental levels (Álvarez-Muñoz et al., 2015; Yu and Wu, 2015; Ros et al., 2016). Solid-phase extraction (SPE) was applied because it is the simplest and least complex extraction and clean-up step. Most previous studies conducted by Liu et al. (2004), Bayen et al. (2013) and Omar et al.

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