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Baseline

Bisphenol A and alkylphenols concentrations in selected mariculture fish species from Pulau Kukup, Johor, Malaysia

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ABSTRACT

Endocrine disrupting compound (EDC) contamination in food is a global concern. Concerning potential environmental and human health exposed to EDCs via food intake, an experiment was conducted on the selected EDCs concentration in the mariculture fish, *Trachinotus blochii* (golden pomfret), *Lutjanus campechanus* (snapper), and *Lates calcarifer* (sea bass) at Pulau Kukup, Johor. Mariculture activity at Pulau Kukup involves active export of fishes to Singapore and Indonesia. The recovery of BPA (bisphenol A), 4OP (4-octylphenol), and 4NP (4-nonylphenol) were 61.54%–93.00%, 16.79%–17.13%, and 61.24%–71.49%, respectively. Relatively high concentration of BPA was recorded in *T. blochii* (0.322 ng/g), followed by *L. calcarifer* (0.124 ng/g) and *L. campechanus* (0.023 ng/g). Furthermore, 4OP and 4NP were detected only in *T. blochii* at concentrations of 0.084 ng/g and 0.078 ng/g, respectively. The results of the present study provide insights on monitoring and managing mariculture activity in relation to environmental protection and food safety.

In the last decade, endocrine disrupting compounds (EDCs) comprising natural and synthetic chemicals have been proven to disrupt and alter endocrine system of animals, plants, and humans even at a concentration as low as ng/L (Luo et al., 2017; Mijangos et al., 2015). The disruption of endocrine system is due to the ability of EDCs to (i) block and copy the usual effect of hormones, (ii) interrupt the synthesis and metabolism of hormones, and (iii) alter the hormone receptor levels (Hibberd et al., 2009). The exposure of water, soil, sediment, and biota to EDCs results mainly from (i) industrial and household discharges, (ii) landfill leachate, (iii) agriculture runoff, and (iv) wastewater and sewage treatment plant effluents (Liu et al., 2016; Pedersen and Lindholst, 1999). The EDCs that enter the water body is adsorbed to the sediment, which leads to bioaccumulation and biomagnification along the food chain or in the food web with humans as final consumer (Ismail et al., 2017). In fish, the EDCs accumulate via diffusion through gills and skin, with a higher accumulation rate than that of the surrounding water (Luo et al., 2017).

Bisphenol A (BPA) is widely used in the (i) production of polycarbonate plastics, epoxy resins, and flame retardants (Giulivo et al., 2016), (ii) manufacture of household products, such as detergents (Salgueiro-González et al., 2016; Hibberd et al., 2009), and (iii) packages of personal care products (Esteve et al., 2016; Huang et al., 2016). On the other hand, alkylphenols (APs) are widely used in the production of surfactants. Subsequently, BPA and APs were introduced into the environment via manufacturing discharges, and also from treatment plants as biodegradation products (Grześkowiak et al., 2016). Exposure to BPA and APs can cause abnormal cell proliferation (e.g., breast cancer), alter the growth and body development, and disturb the reproductive health by reducing the fertility (DeMatteo et al., 2013). While in fish, Oberdörster and Cheek (2001) reported behavior changes in salmon when exposed to 4-nonylphenol (4NP). The United States Environmental Protection Agency (US EPA) reported that one of the factors that trigger feminization of fish is the chemicals in wastewater treatment plant effluents (Kabir et al., 2015).

Due to the high toxicity and carcinogenicity, the use of BPA and APs has been banned and severely supervised in many countries (Duan et al., 2014). Subsequently, APs were included in the list of 45 priority substances in the water policy under the Directive 2013/39/EU. Furthermore, the use of BPA in the manufacture of plastic feeding bottle for infants was restricted under the Directive 2011/8/EU (Commission Directive, 2011/2). The US EPA has strictly restricted the amount of BPA and/or APs in various industrial products, including canned food items (Huang et al., 2016).

Industrial and mariculture activities are the domain activities in Pulau Kukup, Johor. Consequently, mariculture products are potentially exposed to BPA and APs generated from the surrounding industries. However, the concentration of BPA, 4-octylphenol (4OP), and 4NP in the mariculture fish species that are actively exported to the neighboring countries, such as Singapore and Indonesia, remains unknown. Therefore, the aim of the present study involved the baseline

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