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Short Communication

From Mussel Watch Monitoring to Health Risk Assessment: A Public Health Concern

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Introduction

In this review paper, the International Mussel Watch Program (IMWP) in the monitoring of toxic chemicals such as heavy metals in the coastal waters is highlighted. Briefly, the IMWP is initiated by Goldberg (1975) with an aim to monitor the chemical contaminants in the coastal waters. The use of Mussel Watch approach for the monitoring of chemical pollutants in the coastal waters has been conducted in many countries around the world such as USA (Apeti et al., 2010; Edwards et al., 2014) [1,2] Turkey (Belivermis et al., 2016) [3], China (Fung et al., 2004) [4], India (Sasikumar et al., 2006) [5], Hong Kong (Fang et al., 2008) [6], Croatia (Bogdanovic et al., 2014) [7], South-east England (Bray et al., 2015) [8], Libya (Galgani et al., 2014) [9] and Philippines (Dumalagan et al., 2010) [10]. The aim of this review paper is to discuss the significance of Human Health Risk Assessments (HHRA) of chemical pollutants from the Mussel Watch monitoring data.

Genetic factor

Biomonitoring of heavy metal pollution in the coastal waters will provide baseline information of the chemical data for future reference (Yap et al., 2003) [11]. For valid comparison of chemical data, a single species of biomonitor mussels collected from different geographical sites is recommended (Phillips and Rainbow, 1993) [12]. Nonetheless, such monitoring studies using a biomonitor such as marine mussels are always subjected to a lot of controversies because of uncertainties in the genetics composition of the supposedly similar mussel species. From a biological point of view, only a single species can be reliably used to become a good biomonitor of chemical pollution (Yap et al., 2002) [19]. With our studies from 2002 until 2008 based on the green-lipped mussels Perna viridis from Peninsular Malaysia, our findings based on allozyme biomarkers and microsatellites supported our view that P. viridis collected from Peninsular Malaysia can be employed as a good biomonitor. This is because of the genetic differentiation and the genetic polymorphism of the different mussel geographical populations are still low enough (Yap and Tan, 2011) [14]. However, we found that there are higher degrees of genetic differentiation in the polluted coastal waters of the eastern Johore Causeway of the Straits of Johore, indicating the mussels are in the process of evolving to become a subspecies in the adaptation of the polluted conditions (Yap et al., 2004a, 2007, 2013) [11,15,16]. This hypothesis shall be of acceptable to common thinking because of Darwinian Theory of adaptation to changing environment for the species evolution to sustain their survivals. According to Webster's New World College Dictionary (2014), 'Charles Darwin's theory of evolution, which holds that all species of plants and animals developed from earlier forms by hereditary transmission of slight variations in successive generations, and that natural selection determines which forms will survive.'

Biotic and abiotic factors

In addition, there are also many biotic factors such as maturity status or spawning conditions of the mussels that can potentially affect the accuracy of the chemical quantity in frequencies and water salinity can also influence of the accumulation of the chemicals in the body of the mussels. All the above factors are sometimes happening in the single area of sampling sites such as west coast of Peninsular Malaysia (Yap et al., 2002; Yap and Al-Barwani, 2012) [17,18] even though the samplings were conducted within a short interval possible between the northern and southern part of Peninsular Malaysia. Therefore, comparison of chemical concentrations measured in the soft tissue of marine mussels collected from different sampling sites with broader geographical distances are sometimes invalid without considering the factors of genetic, and other biotic and abiotic parameters (Lobel et al., 1991; Yap et al., 2016) [19,20].

Monitoring data for health risk assessment

The uncertainty of whether the bio-monitoring data in the mussels collected from a broad geographical area (for instance; comparison of heavy metal levels in P. viridis collected from India and Hong Kong) are comparable could be raised up. This is due to possible existence of different species or subspecies populations. Therefore, if the objective of study is to estimate the HHRA based on the edible soft tissues of the different geographical mussel populations, whether they are of a single similar species population will not be an issue from the public perspective. The public concern is whether the seafood mussels are safe to be consumed. This public health concern is very much supportive of the view by Widdows and Donkin (1992) [21] that stated 'to protect human health by estimating exposure of chemical contaminants via dietary route back to man', in one the main objectives of the Mussel Watch approach. Since comparison of chemical pollutants in the soft tissue of the mussels is not the main objective of the study, we do not discuss the issues of the factors of genetic, biotic and abiotic, that could influence the accumulation strategies of the mussels. Current literatures on the heavy metals reported in mussels always focus on Estimated Daily Intake (EDI) (that takes consumer's body weight and consumption rate into account) and Target Hazard Quotient (THQ) that compares between EDI and reference dose of each metal investigated. It is noteworthy that papers with information on EDI and THQ of biomonitors are potentially accepted in high ranked ISI journals Such as in fish (Yap et al., 2015) [22], mussels (Yap et al. 2004b, 2016) [23,24] and snails (Cheng and Yap, 2015) [25]. This truly reflects the fact that 'to protect human health by estimating exposure of chemical contaminants via dietary route back to man' [26-28].

Conclusion

Finally, it is concluded that monitoring data of Mussel Watch should be of public health concerns. Towards this end, estimation of

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HHRA of the biomonitor mussels (which is also seafood delicacy) is essential because this is of high relevancy to us. If we pollute our coastal environment, we must be ready to face the consequences. The HHRA of the pollutants in the mussels should be estimated in order to avoid any unprecedented diseases, due to the consumption of contaminated seafood mussels.

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