Malays. Appl. Biol. (2019) 48(5): 39–48

COMPARATIVE STUDIES ON PHYSICOCHEMICAL CHARACTERISATION, ANTIOXIDANT AND ANTIBACTERIAL ACTIVITY OF CHITOSAN EXTRACTED FROM *Scylla paramamosain* AND *Penaeus monodon* SHELLS

WAN ROSLINA WAN YUSOF[1*], MUHD AMIR ASYRAF NOH[2], NOR AIMUNI ABD AZIZ[2], NOORASMIN MOKHTAR AHMAD[2] and AWANG AHMAD SALLEHIN AWANG HUSAINI[2]

[1]*Centre for Pre-University Studies, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia*
[2]*Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia*
[*]*E-mail: wywroslina@unimas.my*

Accepted 20 October 2019, Published online 31 December 2019

ABSTRACT

Marine shells are commonly discarded as waste. However, they could be used to extract a multi versatile polymer, chitosan. As one of the marine by-products, chitosan can be found in the exoskeleton of crustaceans via the deacetylation process of chitin. This project aimed to investigate and compare the physicochemical and biological properties of chitosan extracted from two marine organisms because the properties depend upon the chitin source. In brief, chitosan was extracted through chemical processes from mud crab, *Scylla paramamosain* and prawn, *Penaeus monodon* shells. The percentage yield, moisture, solubility, water binding capacity and fat binding capacity of the extracted chitosan were determined. The degree of deacetylation and SEM images of the extracted chitosan were obtained. The antioxidant and antibacterial properties in both chitosan were evaluated. The results showed that chitosan from *S. paramamosain* shells has a higher percentage yield, moisture content, water binding capacity, fat binding capacity and degree of deacetylation compared to chitosan from *P. monodon* shells. In antioxidant assays, chitosan from *S. paramamosain* shells showed higher scavenging activity (22.2%) than chitosan from *P. monodon* shells (6.7%). In disk diffusion assay, chitosan from *S. paramamosain* shells displayed antibacterial activity against *E. coli* and *S. aureus*, while chitosan from *P. monodon* shells showed no activity. Thus, the study showed that *S. paramamosain* shells could be used as a starting material to produce valuable chitosan with high potential of its biological activities.

Key words: Chitosan, marine by-products, mud crab, prawn, antioxidants, antibacterial

INTRODUCTION

Recently, there has been increasing interest regarding chitosan-based materials due to its natural characteristic and multifunctional polysaccharide (Romainor *et al*., 2014; Cheung *et al*., 2015). This biodegradable copolymer is a weak base and non-toxic material. It consists of repeating units of D-glucosamine (GlcN) and N-acetyl-D-glucosamine (GlcNAc). The ratio of GlcN and GlcNAc determined the percentage of deacetylation (DD) for chitosan, which can be analysed via infra-red (IR) spectroscopy, potentiometric titration, nuclear magnetic resonance (NMR) spectroscopy and X-Ray diffraction pattern analysis (Lago *et al*., 2011). Interestingly, chitosan is available in wide range of DD and molecular weight. Based on the literature, the lowest DD values ranges between 40 to 60% and the highest ranges from 85 to 98% (Hussain *et al*., 2014). The presence of primary amino groups making it displays a cationic character. Due to this unique property, this natural copolymer has been applied in the development of bioactive materials such as in food packaging (Lago *et al*., 2011), in drug delivery systems (Bernkop-Schnürch & Dünnhaupt, 2012) and in wastewater treatment (Vidal & Moraes, 2018). Chitosan acts as an antibacterial agent due to interaction between cationic NH_3^+ group in chitosan with a negative charge of bacterial membrane (Li *et al*., 2015). This

* To whom correspondence should be addressed.