ABSTRACT

This thesis describes the isolation and characterisation of chitin obtained from the exoskeleton of five Jamaican arthropods. These were the crustaceans marine spiny lobster (*Panulirus argus),* the land crab (*Gecarcinus ruricola*), the marine blue crab (*Callinectes sapidus*) and the giant Malaysian fresh water prawn (*Macrobracium rosenberg*). The other arthropod investigated was the drummer cockroach *Blaberus discoidalis.*

Isolation of chitin from crustacean shells involved acid digestion of calcium salts, present in these shells followed by base hydrolysis of the shell proteins. Instrumental Neutron Activation Analysis (INAA), weight loss procedures, Atomic Absorption Spectroscopy (AAS) were the techniques involved in the quantification of the isolated chitin.

INAA allowed for the elemental composition of the shell samples to be determined. Shells were shown to contain calcium, sodium, potassium, bromine, aluminium, manganese and chlorine. With the use of Gas Chromatography Mass Spectrometry (GCMS) organic compounds like amines, high molecular weight carboxylic acid and alkanes were also indicated. Complexation was shown to be a workable alternative to acid digestion.

The percent content of calcium expressed as calcium carbonate of the shells of the marine spiny lobster, land crab, blue crab and the giant Malaysian fresh water prawn was determined to be 42, 70, 65 and 47%, respectively.

The digestion efficiency for extraction of calcium varied significantly with species, as well as with the strength of the acid and the digestion time used.

Standard acid hydrolysis was not effective in removing all calcium compounds from the shells of some species of crustaceans.

The percentage by weight of chitin obtained from these crustacean shells were found to be; Lobster 21%, land crab 18%, blue crab 19% and prawn 35%.

Characterisation involved the use of Thermogravimetric Analysis (TGA) and Differential Scanning Calorimetry (DSC)), Scanning electron Microscopy (SEM), carbon-13 NMR Spectroscopy and Infrared analysis. TGA and DSC show that chitin is stable up to 394 °C. SEM showed by photographs the fibrous nature of chitin. Carbon-13 NMR analysis showed chemical shift values that compared well with literature values for glucose and IR analysis showed the characteristic hydroxide band (3450 cm^{-1}) and amide absorption band (1655 cm^{-1}) associated with chitin.

Characterisation of chitin also involved determination of the percentage N-acetyl content (% N-Ac) by the use of two infrared analysis techniques where (% N-Ac = $A_{1655}/A_{3450} \times 115$) and (% N-Ac = $A_{1655}/A_{3450} \times 100/1.33$). A typical isolation process to produce chitin showed varying percent N-acetyl content, which is affected by the alkaline conditions of the hydrolysis step as well as the method of calculation.

The conversion of chitin to chitosan was also a method of characterisation of chitin where chitosan was soluble in dilute acetic acid.

Key words: chitin, crustacean shells Instrumental Neutron Activation Analysis, weight loss, and calcium carbonate.