Indian J.L.Sci. 6 (1) : 47-50, 2017
ISSN : 2277-1743 (Print)
ISSN : 2278-7879 (Online)

DETERMINATION OF CALCIUM CONTENT IN SHELLS OF BIVALVES OF CHIPPALERU CREEK OF ANDHRA PRADESH

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ABSTRACT

Various sources of calcium are used for preparation of drug containing calcium. Among them most important are calcium from the $CaCO_3$ stones produced from mining, from the protozoan's like Foraminifera shells, Mollusk shells such as pearls, cones and from the corals. Different sources of calcium produce different amounts or quantities. In ayurvedic medicine Sanku(Shell) Bhasma is used for treating varius disroders after calcinationg different type of shells. The quality and quantity of calcium is not uniformal even in a particular class of molluscan shells. Hence in the present study an attempt is made to evaluate the quantity of calcium obtained from different bivalve shell sources. Different bivalve shells collected from the sea shore of Bay of Bengal near Lakshmipuram Village, Kavali Mandal of SPSR Nellore district, Andhra Pradesh, India, they were immersed in boiling water 30 seconds and the soft tissues were removed. The shells were dried at room temperature for four days and weighed (100 mg). The calcium content was estimated by the modified method of Pinheiro and Amato (1995). The chemical diversity of calcium content in different bivalves that are present in the Coramandal coste of Nellore district is studied to harness the potentiality of using calcium from different bivalves. Calcium carbonate can take the form of two different minerals. Calcite is the stable form, whereas aragonite is metastable. The ratios of these two are also different in different bivalves shells. The results show that there is significant variations in the calcium carbonate and ash content in different bivalves of Coramandal coste of Nellore district.

KEYWORDS : Bivalve Shells, Lakshmipuram Estuary, Calcium and Ash Content

Sea shells are formed by the process of bio-mineralization where living organisms produce inorganic solids ((Boskey and Mendelsohn, 2005, Barth el at., 2007, Espinosa et.al., 2009. Sea shells are the protective layers of marine animals called mollusks and other sea animals. It includes clams, oysters and snails. Most of these animals do not have a backbone and are called invertebrates. Shells are mostly made of calcium carbonate with a little bit of protein mixed in as well. Calcium carbonate does not dissolve in water and is made by calcium ions that are secreted from cells of these animals and the carbonate ions present in water. The shell grows from the bottom up with the material that makes up the layers added in layers. Proteins secreted by the animals' body helps in the crystallization process (Ruppert et. al., 2004, Marin and Luquet 2005 Porter 2007, Checa et.al. 2009. Jackson et al., 2010) . The shell grows outwards at its margins. As the animal ages, the shell gets larger and more calcium carbonate is exuded from the mantle. Color patterns are specific to different species making is relatively easy to tell different species apart. While some shells are similar, most differences are recognizable to the naked eye. After the animal dies, the durable shell remains. Ocean currents carry shells underwater where they often come to rest on the beach.

Seawater acidification will lead to a shift in inorganic carbon equilibria towards higher CO_2 and lower carbonate ion (CO_3^{-2}) concentrations. The carbonate ion is one of the building blocks of calcium carbonate ($CaCO_3$) and changes in its ambient concentration can thus affect the ability of calcifying organisms to precipitate $CaCO_3$.

Marine organisms such as coral reefs, foraminifera, coralline algae and mollusks can produce calcareous skeletons or shells following the simplified reaction:

$$CO_3^{-2} + Ca^{+2} \longrightarrow CaCO_3 \quad (1)$$

As, at a constant salinity, calcium concentration is rather constant in the ocean, the calcification process mainly depends on the availability of CO_3^{-2}. The calcium carbonate saturation state:

$$\Omega = \frac{[CO_3^{-2}]\ [Ca^{+2}]}{K^1_{sp}} \quad (2)$$

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where K'_{sp} is the stoichiometric solubility product (dependent on temperature, salinity, pressure and on the considered mineral phase: calcite, aragonite or high-magnesian calcite) will therefore decrease although, the surface ocean will remain almost entirely supersaturated ($\Omega > 1$) with respect to calcite and aragonite, the only exception being Ω aragonite in cold waters (Orr et al., 2005).

Several experiments have shown a reduction of calcification and size at elevated pCO_2 in corals, coralline algae, coccolithophorids and foraminifera (Agegian, 1985; Bijma et al., 1999; Leclercq et al., 2000; Langdon and Atkinson, 2005). Few studies have investigated the detrimental effect of acidic waters on bivalves (Bamber, 1990; Michaelidis et al., 2005; Berge et al., 2006). There is a rampant change in the marine environment due to pollution and port activities. (Narasimha Murthy, and Ravanaiah, 2010) Hence in the present study an attempt is made to evaluate the quantity of calcium obtained from different sources such as bivalve snails in the sea shore of Bay of Bengal near Lakshmipuram Village, Kavali Mandal of Sri Potti Sriramulu Nellore district, Andhra Pradesh. In addition, the efficiency of the calcium is also tested for medicinal use.

MATERIALS AND METHODS

Different bivalve shells collected from the sea shore of Bay of Bengal near Lakshmipuram Village, Kavali Mandal of SPSR Nellore district, Andhra Pradesh, India, were immersed in boiling water 30 seconds and the soft tissues were removed. The shells were dried at room temperature four days and weighed (100 mg). The calcium content was estimated by the modified method of Pinheiro and Amato (1995) and later described by Soido et al. 2009. The dried shells were transferred to a porcelain non-porous cubicle, previously rinsed with conc. HNO_3. The shells were calcined on a stove at 450ºC for 48 hours. This occurred under temperatures above 250ºC (Baccan et. al. 2000) to eliminate the organic matter existing in the shell. The calcine ashes contain the minerals. After that, the ashes were weighed and diluted in 50 mL of conc. HNO_3 and maintained in a digester for about six hours and added 2 mL of H_2O_2 to allow the clarification of the resulting solution. The sample was also diluted to a hundred times and prepared five aliquots of 25 mL. Each sample was taken for calcium determination using disodium salt of ethylenediamine tetraacetic acid (Na_2EDTA) (1973). The calcium carbonate mass was calculated using the volume of Na_2EDTA wasted in the titration process and expressed as mg of $CaCO_3$/g for shell content (treatment 1) or mg of $CaCO_3$/g for ash content.

The data is presented in the table 1. There are significant differences in the ash and calcium contents of different bivalve shells that were collected near Chippaleru estuary, Bay of Bengal near Lakshimipuram village.

1. Since $F_{CR} > F_{tR}$ at 5% level H01 is rejected. Hence there is very high significant difference between the first type of treatments which are arranged in rows. So Calcium contents differ significantly.
2. Since $F_{CC} > F_{tC}$ at 5% level H01 cannot be rejected. So

Table 1 : Calcium Contents of Various Bivalve Shells of Chippaleru Estuary. Values are Mean of 10 Observations. ± Denotes Standard Deviation

S.No.	Scientific name	Common name	Length (units)	Calcium concentration (mg of $CaCO_3$/g of ashes)
1	*Anadara granosa*	Cockle	25 – 86	789.4 ± 25.8
2	*Crassostrea madrasensis*	Chinese oyster	10 – 40	678.9.9 ± 22.7
3	*Gelonia bengalensis*	Big black clam	18 – 52	707.5 ± 24.9
4	*Meretrix casta*	Yellow clam	33 – 86	673.4 ± 23.3
5	*Meretrix meretrix*	Yellow clam	12 –34	736.9 ± 23.4
6	*Perna viridis*	Green mussel	35 - 56	774.3 ± 37.1
7	*Placenta placenta*	Window pane oyster	10 – 78	734.5 ± 15.2
8	*Villorita cyprinoides*	Black clam	35 – 88	785.9 ± 27.7
9	*Phapia malabarica*	Short neck calm	60 – 160	773.7 ± 25.4

Table 2 : ANOVA Test

Source Variation (SV)	Degrees of Freedom (df)	Sum of Squares (SS)	Mean Sum of Squares (MSS)	F- calculated Value (F_c)	F-Table vaue (F_t)
Rows	8	161208.7	20151.09	434.6578	2.0698
Columns	9	408.7222	45.41358	0.46425	2.01275
Error	72	3337.978	46.3608		
Total	89				

all the lengths of the units are equal effects. Hence there is no significant difference between the lengths of the units.

RESULTS AND DISCUSSION

The data reveal that there is a significant variation in the Calcium carbonate content in different Bivalve shells. Apart from this there are structural variations are also there in different shells.

The Calcium Concentration is varied in different Bivalve shells. These shells can be used for preparation of Calcium for the medicinal purpose.

ACKNOWLEDGEMENT

The authors thank UGC for financial support in the form of Minor Research project.

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