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Determination of calcium content in shells of gastropod snails of Ramayapatnam beach of Andhra Pradesh

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ABSTRACT

For preparation of drug containing calcium various sources of calcium is used. Among them most important are calcium from the $CaCO_3$ stones produced from the mining, calcium produced from the protozoan's like Foraminifera shells, mollusk shells such as pearls, comes and Calcium produced from the corals. The quantity of the calcium that is produced from different sources is not one and same. Seashells are excreted from the outer surface of the animal called the mantle and are made up of mostly calcium carbonate. Calcium carbonate can take the form of two different minerals, Calcite is the stable form, whereas aragonite is metastable, over time, or when heated, it can ultimately transform into calcite. In the present study an attempt is made to study the range of concentration of calcium carbonate in the shells of various gastropods in the sea shore of Bay of Bengal near Ramayapatnam Village, Gudlur Mandal of Praksam district Andhra Pradesh, India . The percentage of ash content and calcium content was determined using EDTA titrimetrically. The data shows there is a significant variation in the ash and calcium content of different species of gastropod shells. The significance of the variations in calcium content and its implications are discussed.

Key words: Gastropod snail shells, Ramayapatnam Beach, Calcium and Ash content

INTRODUCTION

Sea shells are formed by the process of bio-mineralization where living organisms produce inorganic solids [4,7,10]. 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 [9, 11, 15, 22]. 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.

After the animal dies, the durable shell remains. Ocean currents carry shells underwater where they often come to rest on the beach. Calcium carbonate can take the form of two different minerals. Calcite is the stable form, whereas aragonite is metastable. Over time, or when heated, it can ultimately transform into calcite. For preparation of drug containing calcium various sources of calcium is used. Among them most important are calcium from the $CaCO_3$

stones produced from the mining, calcium produced from the protozoan's like Foraminifera shells, mollusk shells such as pearls, comes and Calcium produced from the corals. The quantity of the calcium that is produced from different sources is not one and same.

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

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

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:

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

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 [6, 12, 14]. Few studies have investigated the detrimental effect of acidic waters on bivalves [2, 5, 17]. There is a rampent change in the marine environment due to pollution and port activities [18]. 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.

Hence in the present study an attempt will be made to evaluate the quantity of calcium obtained from different sources. In addition to that the efficiency of the calcium will be tested for medicinal use. In the present study an attempt is made to study the calcium content of selected gastropod snails in the sea shore of Bay of Bengal near Ramayapatnam Village, Gudlur Mandal of Praksam district Andhra Pradesh, India .

EXPERIMENTAL SECTION

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 [20] and later described by [23]. 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 [1] 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) [16]. 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.

RESULTS AND DISCUSSION

The data is presented in the table. There is significant variations in the ash and calcium content of different gastropod snail shells in the Ramayapattanam beach.

1. Since R^2 – value is very high the fit is suitable to the data

2. Since $F_{CR} > Ft_R$, H_0 is ejected. So all the factors effects are not same. Hence significant different existed between the factors.

Table:1 Calcium contents of various Gastropode snail shells of Ramayapatnam beach

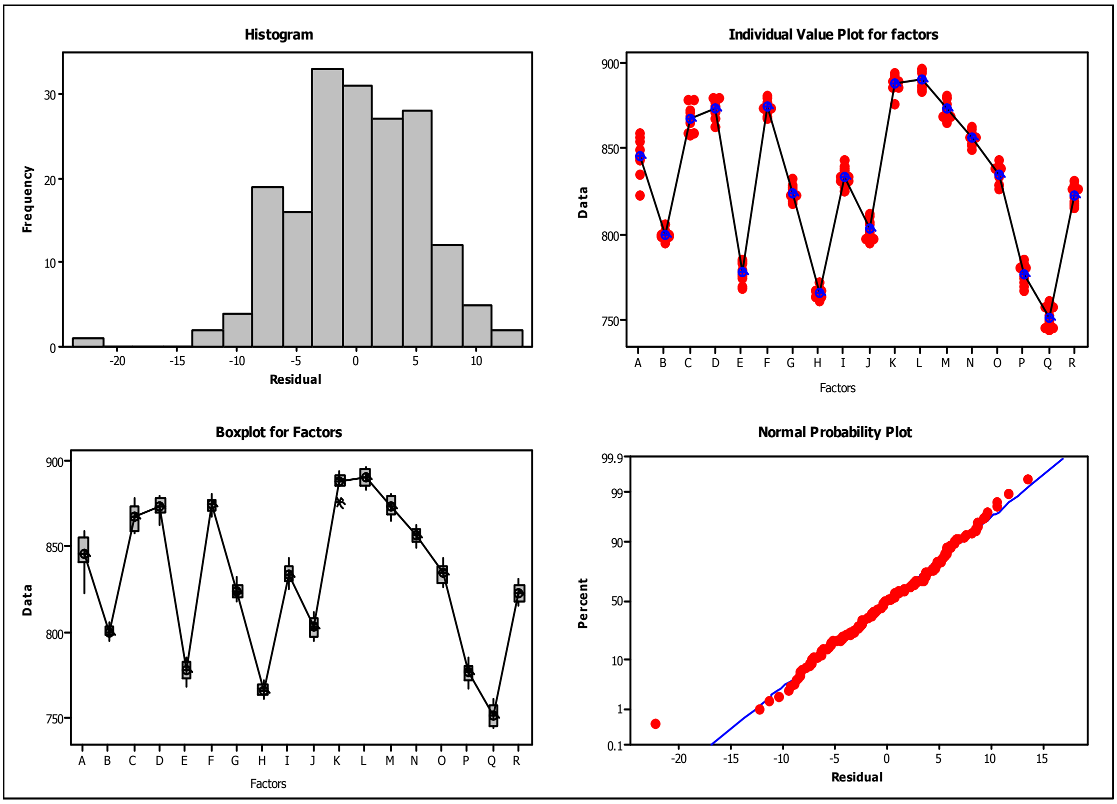
Values are mean of 10 observations. ± denotes stand ard deviation.

S.No.	Common name	Scientific name	**Calcium concentration (mg of CaCO3/g of ashes)**	Shell ash Percent
1	Alphabet Cone	*Conus spurious*	845.4±37.8	34.6
2	Angulate Periwinkle	*Littorina angulifera*	799.9±22.7	39.8
3	Apple Murex	*Phyllonotus pomum*	867.5±48.9	32.4
4	Beaded Periwinkle	*Tectarius muricatus*	873.4±37.3	30.7
5	Channel Whelk	*Busycotypus canaliculatus*	776.9±46.4	39.1
6	Fighting conch	*Strombus alatus*	874.3±69.1	35.6
7	Florida Auger	*Terebra floridana*	823.5±77.2	37.3
8	Florida Cone	*Conus floridanus*	765.9±33.7	41.4
9	Fly-Specked Cerith	*Cerithium muscarum*	833.7±45.4	34.7
10	Horse Conch	*Pleuroploca gigantea*	802.5±58.6	34.3
11	Junonia	*Scaphella junonia*	888.4±53.6	31.8
12	Knobby Whelk	*Busycon carica*	890.2±38.6	30.2
13	Lace Murex	*Chicoreus dilectus*	873.6±39.9	32.5
14	Nutmeg	*Cancellaria reticulata*	856.3±67.4	33.4
15	Paper Fig	*Ficus communis*	834.4±49.7	36.8
16	Pear Whelk	*Busycon spiratum*	776.3±33.8	39.4
17	Scotch Bonnet	*Phalium granulatum*	751.3±78.4	41.3
18	Sozon's Cone	*Conus delessertii*	822.5±67.2	39.3

Table: 2 : One Way ANOVA

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)
Facts	17	329021	19354.2	584.87	0.0000
Error	162	5360.8	33.1		
Total	179	334381.8			

S-value = 5.753, R^2 - value = 98.4% and R^2 – adjusted value = 98.23%



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

Calcium carbonate usually crystallizes as calcite, but surprisingly, it forms aragonite in seawater. The outcome affects many different processes including the global carbon cycle, neutralizing carbon dioxide in the atmosphere into a stable mineral and limiting its buildup in the air. It also affects the formation of shells and corals, whose aragonite shells are vulnerable to the ocean acidification associated with climate change. Two different forms of calcium carbonate have identical chemical composition, but look different and have different properties such as solubility. The flat, clear crystal is calcite, the pinkish multifaceted one is aragonite. Biodiversity is observed in the shell calcium content in the various gastropods.

CONCLUSION

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

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