



# “Synthesis of Calcium Amino Acid Complex by Using Waste White and Brown Chicken Eggshell”

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**ABSTRACT-** The role of science to mimic the nature. The complexation between calcium and amino acid is going to be a step towards the same. In the present study, calcium carbonate (extracted from chicken eggshell) and two amino acids (glutamic acid, valine) have been used to synthesized organometallic complex at particular condition. The complex has been characterized by FT-IR analysis. The study reveals that the complex is binary in nature.

**KEYWORDS-** Chicken Eggshell, Glutamic acid, valine, FT-IR

## I. INTRODUCTION

Eggs are a part of fundamental nourishment for human utilization and contain a large amount of the essential supplements [1,2]. Eggs have every one of the significant supplements like protein amino acids, cell reinforcements, and bioactive parts [3-6]. The chicken egg is shaped from around 66% white and 33% yolk. The yolk contains lipids, nutrients, minerals and carotenoid colors [7]. The eggshell comprises of 95% of calcium carbonate, 3.5% of glycoproteins and proteoglycans [8]. The inward shell film contains glucosamine chondroitin sulfate, hyaluronic corrosive and a high measure of proteins and microelements like magnesium, strontium, zinc, barium, fluorine [9].

Amino acids are natural mixtures that contain amino (- NH<sub>2</sub>) and carboxyl (- COOH) useful gatherings, alongside a side chain (R bunch) specific to every amino acid. The key components often amino corrosive are carbon ©, hydrogen (H), oxygen (O), and nitrogen (N), albeit different components are found in the side chains of certain amino acids. They can be ordered by the center primary utilitarian gatherings' areas as alpha-, beta-, gamma- or delta-amino acids; different classifications identify with extremity, pH level, and side chain bunch type In the structure of proteins, amino corrosive deposits form the second-biggest part (water is the biggest) of human muscles and other tissues [10]

## 2. Experimental Section

### Materials

Chicken Eggshell, dil. Water (dil. water is prepared by Distillation Process and used as such). The Conductivity and pH of distilled water is 2-5  $\mu\text{S}/\text{cm}$  and 6.78, respectively, HCL, Amino Acid (Glutamic acid, valine).

### 3. Method

#### 3.1. Calcium Carbonate extraction from Waste Eggshell

Waste egg shells was collected and washed by using distilled water & sodium lauryl sulphate for several time at room temperture. The washed eggshell has been heated at 100°C for 2-3 hrs. Make sure eggshell stay inside the boiling water. After completely boiled, remove membrane (protein) layer from the egg hard shell. The remaining hard eggshell layer dry in air oven at 60°C for 3-4 hrs. The dry shell crushed in mortar pastell to make a white calcium carbonate ( $\text{CaCO}_3$ ) powder and packed in air tight zip bag.

#### 3.2. Preparation Of Calcium Amino Acids Complex

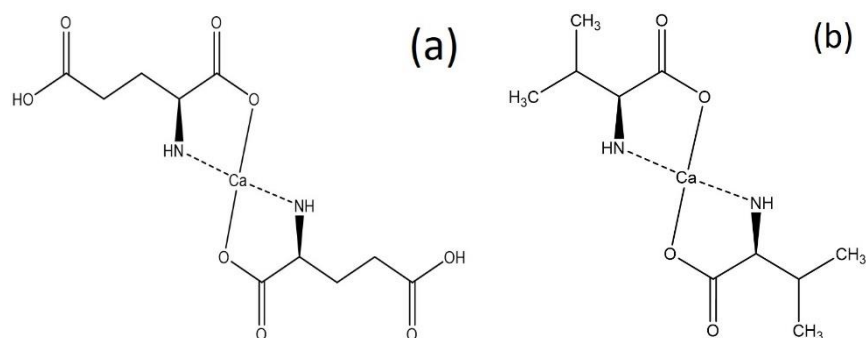
$\text{CaCO}_3$  (20 gram, 1 mol) extracted dry powder, conc. HCl (48.66 ml, 30% conc.) and distilled water (60 ml) was stirred at room temperture untill the ph is not achive between 5-6. Conc. HCl added drop by drop in the reaction. The solution mixture of  $\text{CaCl}_2$  was used directly for synthesis of calcium – amino acid complex.

The calcium chloride solution and 1 gm amino acid (glutamic acid, valine) was heated and refluxed for 6 hr in aqeous solution. The resulting mixture was remain as such for the settlement of the solid. Drain out the top liquid and remaining solid mass was collected in petri dish for the air dry. The dry solid mass crushed and packed in air tight container.

#### 3.3. FT-IR Analysis

The complex have been analysed with dry KBr (pressurized pallet) on FT-IR instrument (Perkin Elmer Spectrum Two, 0.1 $\text{cm}^{-1}$  accuracy and 0.01 $\text{cm}^{-1}$  precision) at room temperature.

#### 4. Result and Discussion



**Figure 1.** Structural representation of Ca Amino acid complex: **a)**  $\text{Ca}(\text{Glu})_2$  **b)**  $\text{Ca}(\text{Val})_2$

Two complexes (calcium-glutamic acid,  $\text{Ca}(\text{Glu})_2$  and calcium-valine,  $\text{Ca}(\text{Val})_2$ ) have been synthesised and proposed as per the literature survey (Fig. 1). Both the Amino acids contain amine groups which are hydrophilic in nature and capable of forming hydrogen bonds. The carboxylic acid is hydrophobic in nature and also capable of forming covalent bonds. Due to the +2 oxidation state of calcium (Ca), two monomers of amino acid (glutamic acid or valine) is going to attach with the Ca. Ca is going to form two covalent bond with carboxylate and two hydrogen bond with amine (for structure see Fig. 1). Due to complexity, the complex will not remain planner.

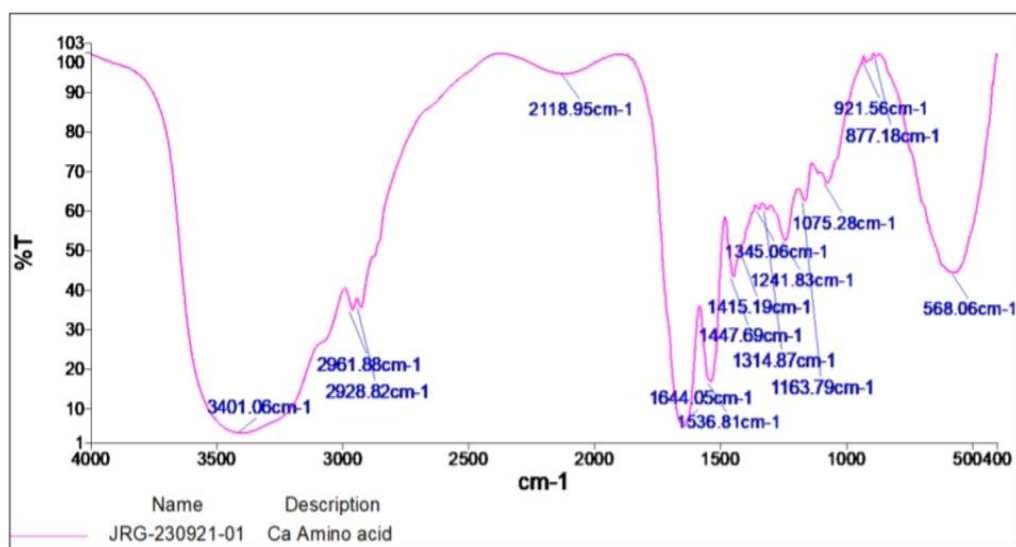
#### 4.2. FT-IR Analysis of Complex

Alkali group are hydrophilic and capable of forming hydrogen bonds. They attached to calcium with covalent bond and the calcium ion oxidation state is +2 and color is white and calcium. Valine is attached with Ca in hydrated form with a binary structure. The structure is proposed as per literature survey. Ca is bind with oxygen and nitrogen in form of covalent bond of valine which is found symmetric in nature. 3D proposed structure of Ca-Glutamic clearly suggest that the complex is not planner. In 3D structure, red, blue, white colors are for Oxygen, Nitrogen, and hydrogen, respectively. The bigger atom is calcium.

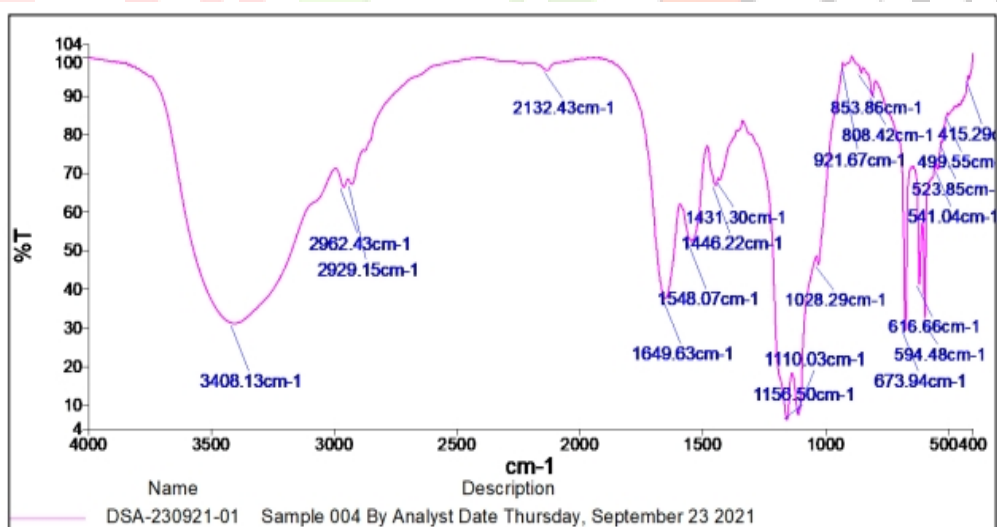
Alkali group are hydrophilic and capable of forming hydrogen bonds. They attached to calcium with covalent bond and the calcium ion oxidation state is +2 and color is white and calcium. Valine is attached with Ca in hydrated form with a binary structure. The structure is proposed as per literature survey. Ca is bind with oxygen and nitrogen in form of covalent bond of valine which is found symmetric in nature. 3D proposed structure of  $\text{Ca}(\text{Val})_2 \cdot n\text{H}_2\text{O}$  clearly suggest that the complex are not planner. In 3D structure, red, blue, white colors are for Oxygen, Nitrogen, and hydrogen, respectively. The bigger atom is calcium

## 4.2. IR Data

IR spectrum of Ca-Glu Complex is shown in figure. The characteristics of medium N-H stretching IR bands of complex are found at 3205 cm<sup>-1</sup>. A medium C-H stretching IR band observed at 3000-3100 cm<sup>-1</sup>. A medium peak of O-H stretching found at 2598.79 cm<sup>-1</sup>. The appearance of strong C-O stretching found at 1688.41 cm<sup>-1</sup>. The appearance of C-O Stretching, C-C Stretching observed in between 1220-1440 cm<sup>-1</sup>. A medium peak of C-N stretching observed at 1329.07 cm<sup>-1</sup>. An aromatic ring peak observed at 740 cm<sup>-1</sup> and 799 cm<sup>-1</sup>. These results reveal that the prepared complex contains alkenes, alkanes, and aldehyde. IR spectrum clearly shows that the prepared complex is functionalized properly as literature studies.



IR spectra of Ca-Glu Complex



IR spectra of Ca-Valine Complex

IR spectrum of Ca(valine) Complex is shown in figure. The characteristics of medium N-H stretching IR bands of complex are found at 3408 cm<sup>-1</sup>. The appearance of strong C-O stretching found at 1649 cm<sup>-1</sup>. The appearance of C-O Stretching, C-C Stretching observed in between 1220-1440 cm<sup>-1</sup>. An aromatic ring peak observed

at 808 cm<sup>-1</sup>. These result reveal that prepared complex contains alkenes, alkanes, and aldehyde. IR spectrum clearly shows that the prepared complex functionalized properly as literature studies.

## Conclusion

We have successfully extracted Calcium Carbonate From eggshell. By using this Calcium Powder, we have synthesized Complex by Refluxing calcium and Glutamic in aqueous solution in under CaCl<sub>2</sub> guard tubing Through for 1 hours. We have predicted the structure of Ca (Glu) and Ca(Valine) 2D and 3D structure. Literature suggest that complex is binary, where O and N atom of Glutamic and Valine are attach with Calcium. The structure of Complex is Ca-Glu and Ca-valine. This Kind of complex can be useful of muscle strength and to overcome tissue damage in further study

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