

# **Application of Eggshell as Fertilizer and Calcium Supplement Tablet**

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**ABSTRACT:** Eggshell is discarded as wastes from different sources like hotels, houses etc. They were collected, purified and powdered by mixer. Eggshell powder was used as a fertilizer in a Tomato plant and also used as calcium supplement for females. Extracted calcium from different eggshell was characterized for Fourier Transform Infrared spectroscopy (FTIR) and the data indicated the percentage of calcium in eggshell. pH of soil and percentage of calcium in the soil was tested by soil testing .Eggshell is probably the best natural source of calcium. The purpose of this particular project is mainly to use eggshell in different application like fertilizer, calcium supplement etc.

**KEYWORDS:** Eggshell , Calcium supplement

## **I. INTRODUCTION**

Everyday huge quantity of eggshells are generated as bio- waste around the globe. Eggshells are waste material collected from house and fast food industries .Eggshell waste disposal contribute to environment pollution and also the disposal includes cost, availability of disposal sites. odour of eggshell provides site for flies and abrasiveness . Eggshell which constitutes about 11% of the total weight of the whole egg contains about 91% of  $\text{CaCO}_3$ . [4] In this study we will use eggshell as a fertilizer in plant which might help in decreasing the plant diseases Blossom end root [BER] and also the cost of plantation. It also increases the nutritional intake of plants. [2] Also we will use eggshell as a calcium supplement tablet for females as a substitute for CIPCAL-500.

## **II. MATERIALS**

We used eggshell which are easily available in the market as a raw material in different applications. But eggs obtained from different birds contain varying quantity of calcium .Eggshell was collected from poultry farm, houses, hotels, bakeries, fast food industries etc. Collection of eggshells from these sources in a large amount was done, because of large scale usage of eggs.

After collection they were cleaned with tap water and boiled .12 eggshells were taken in 6 cups of filtered water. They were cooked in it for 10 minutes The shells were drained out. Then they were spread out on glass or stainless steel baking sheet and dried overnight .In the morning, they were dried in oven at 200°C for about 10 minutes. After this, they were pulverized into a granular form by grinding in a mixer.

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Fig 1.Eggshell powder

### III. USES of EGGSHELL

Eggshell contains calcium and trace amounts of other micro elements. Eggshell calcium is best natural source of calcium and it is about 90% absorbable, than limestone or coral sources. The whole medium eggshell makes about one teaspoon of powder.[1],[4] This can be used as fertilizer to treat blossom –end – root (BER) plants and also as calcium supplement tablet for human beings. These two applications would be studied here.

### IV. EXPERIMENTAL WORK

#### A). Plantation of Tomato plant

As tomato plants suffer from BER disease and its major cause is calcium deficiency ,so chicken eggshell would be added as a fertilizer to enrich its calcium intake. Plantation of three tomato plants having different concentration of fertilizer would be done.

#### 1)Addition of fertilizer :-

We prepared three samples of tomato plant. Initially, in 1<sup>st</sup> plant addition of eggshell powder was not done. In 2<sup>nd</sup> and 3<sup>rd</sup> plant addition of an eggshell was done in ratio of 10% and 15% respectively, for 1kg of soil.

#### B. Observation Table

Day	Without eggshell	10% eggshell Powder	15% eggshell powder
7 Day	14.5	15	13
14 Day	15	17	16
21 Day	15	17	16

Table No.1:Fertilizer percentage in soil

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### C. Testing: 1) Soil testing

Sr. No.	Sample	Parameter	Reading (%)
1.	Without Eggshell Soil	Calcium	11.17
2.	10% Eggshell Soil	Calcium	27.13
3.	15% Eggshell Soil	Calcium	19.15

**Table No.2: Soil test results**

Above table shows the percentage of calcium in the soil after one month of adding fertilizer.

### 2) pH testing

Sr. No.	Sample	Parameter	Reading
1	Without Eggshell Soil	pH	5
2.	10% Eggshell Soil	pH	8.7
3.	15% Eggshell Soil	pH	8.17

**Table No.3:pH test results**

## V. EXTRACTION OF CALCIUM

Eggshells of a different eggs of bird contain varying percentage of calcium content so, we extracted Calcium chloride from different eggshells like chicken virgin and artificial eggshell, duck eggshell.

### *Experimental work*

Extraction of calcium chloride was done using 4% (w/v) Hydrochloric Acid (HCl) solution for an extraction period of three hours.

Ratio of eggshell to Hydrochloric acid (HCl) was 1:15 (w/v). After hydrolysis, the residues were removed and solution was heated to 110–115°C until dried.

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Fig 2.Set up for calcium extraction

## VI.EGG SHELL USE as CALCIUM SUPPLEMENT

### *Importance of calcium*

Calcium is a nutrient that is essential for strong bones. Ninety-nine percent of our body's calcium is stored in human bones and teeth. The other one percent of human body's calcium is found in blood. Blood calcium is necessary to support our body's critical functions such as controlling our blood pressure and maintaining heartbeat.

The calcium in our bones makes up our bone bank. Throughout our lifetime, the calcium from the foods we eat is "deposited" in and "withdrawn" from our bone bank, depending on our body needs. When our calcium intake is too low to keep human blood calcium normal our body will "withdraw" the calcium it needs from our bones. Over time, if more calcium is taken out of our bones than is put in, the result may be thin, weak bones that may break more easily.

Age	Calcium needed each day (mg = milligrams)
Birth to 12 months	Supplied by formula or breast milk
1-3	700 mg*
4-8	1000 mg*
9-18	1300 mg*
Men 19 – 70	1000 mg*
Women 19 – 50	1000 mg*
Women 51-70	1200mg

Table No.4:Calcium requirement by human body

### *General method of Calcium extraction from oyster shell*

The mussel and oyster shells are heated in an oven at 200 °C for 1 hour to make the shells more brittle and submitted to milling in a high-speed planetary mill with a porcelain jar and alumina balls for 15 minutes with water. The powders are heated again to 500 °C and maintained for 2 hours and to undo the clusters a new milling is performed without water for 1 minute. The powders are characterized by particle size distribution analyses and chemical composition using a laser diffraction analyzer.[3]

CIPCAL-500 (oyster shell) calcium supplement tablets were taken for analysing calcium carbonate content by FTIR analysis. The weight of one tablet is 1.25 gm. Then the result of calcium carbonate from CIPCAL-500 was compared with calcium carbonate extracted from eggshell.

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## VII.GRAPHICAL INETRPRETATION

From FTIR test we conclude that, different bird’s eggshell contains varying percentage of calcium carbonate. The chicken eggshells like general and virgin (Desi) contains large quantity or percentage of calcium carbonate. From the observation 10 percent eggshell powder is more suitable for growth of tomato plant than 15 percent. From FTIR test of CIPCAL-500 we can conclude that the calcium carbonate extraction from oyster shell is tedious and costly, whereas chicken eggshell with equivalent amount of calcium carbonate is easily extracted and cheap. So, we can get a cheaper substitute as calcium supplement.

Wavelength in cm-1	Length
715	Weak
877	strong
1430	Very strong
1785	Very weak
2530	Very weak

**Table No.5 :Positions and Intensities of Infrared Absorption Bonds for Calcium carbonate**

## VIII. CALCIUM SUPPLEMENT TABLETS

As CIPCAL-500 and artificial chicken eggshell FTIR results were comparable, so an attempt was taken to make calcium supplement tablets out of artificial chicken eggshell powder. The powder was compounded, sieved and granulated. It was then dried in oven at 120°C for two hours. After this the powder was fed to tablet making machine and different sized tablets were made. The CIPCAL -500 and artificial chicken eggshell tablets were tested using calcium dissolution tester. Here the temperature maintained was 37°C and pH was maintained similar to human body pH by providing bath of 0.1N HCl. Both the tablets were placed in cuvette and kept in acid water bath and then subjected to dissolution at a speed of 100 rpm.



**Fig 3. Calcium Dissolution apparatus**

Sr. No.	Type	Weight in gms	Dissolution time in seconds
1.	CIPCAL-500	1.25	100
2.	Chicken eggshell	0.6	50

**Table No.6 : Calcium Dissolution time**

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**Fig 4. Chicken eggshell tablets**

## IX. CONCLUSION

We can conclude that artificial chicken eggshell has rich amount of calcium and this calcium can be used very effectively in various applications. When used as a fertilizer it enriched the pH and calcium content of the soil. This enrichment is very beneficial for plants suffering from blossom –end –root diseases. Examples are :Tomato plants, Berry plants etc.

In another application these chicken eggshell powder was used up to make tablets which were tested for equivalency against CIPCAL-500 calcium supplement tablets. The analysis results were comparable and also the source, availability and extraction of chicken eggshell is much easier as compared to the oyster shell which is the main source of CIPCAL-500 tablets.[11]

So it can be concluded that chicken eggshell cannot be just considered as a waste and can be effectively used for many applications.

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