Regulated Natural Solution Containing Calcium Ions

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Abstract- This paper shows how to prepare a solution containing high concentration of calcium ions and manipulate it to be appropriate for human health. This study shows how to obtain high concentration level of calcium ions from egg shells and lemon juice. The result was C_m= 160mg/l of calcium ions in drinking water while C_m= 240 mg/l of calcium ions in a solution containing distilled water, calcinated eggshells and lemon juice.

Index Term- Solution Containing Calcium Ions: Water liquid that has calcium ions (Ca^{2+}) dissolved in it. Labor Photometer: a machine measures the concentration of ions in mg/l

I. INTRODUCTION

Calcium is found in food, dietary supplements and in medicines (NIH, 2016). It is needed for proper nerve muscle functions, as well as forming strong bones. It is also required for vascular contraction, muscle function, nerve transmission, intracellular signaling and formal secretion. Yet 1% of calcium is needed to support the metabolic functions in the body and the rest 99% is in our teeth and bones (Beto, 2015). That's why the loss in calcium amount is a reason to the loss of bones which leads to increase the risk of osteoporosis especially in old individuals (Surgeon, 2004). Beside osteoporosis, calcium deficiency can cause rickets which is more commonly associated with vitamin D deficiency (Sahay, 2012).

Several studies have investigated the role of calcium in weight management. The increase in calcium intake enhances body weight loss or fat loss. One of the explanations is that calcium from food intake might blind to small amounts of dietary fat in the digestive tract and prevent its absorption.

In contrary if calcium is taken in overdose, it will lead to many risks. Overdose of calcium causes bone pain, depression, irregular heartbeat, and prostate cancer. And because kidney has a role in cleaning extra calcium from the body, the overdose of calcium can harm the kidneys causing impaired kidney function and increases in 17% the risk of kidney stones (Maria Fátima, 2014).

To intake calcium naturally, several foods can be consumed such as, milk, yoghurt and cheese (table 1) (NIH, 2016).

Food	Milligrams (mg) per serving
Milk, reduced fat (2% milk fat), 8 ounces	293
Yogurt, fruit, low fat, 8 ounces	313-384
Cheese, cream, regular, 1 tablespoon	14

Table 1- amount of calcium (mg) in selected food

Egg shells are major source of calcium. The egg produces a great amount of residual shells which pose an environmental pollution as a result of microbial action. The most important ingredient of egg shells is calcium carbonate, which is 94-97% from the total composition and the others are phosphorous, magnesium, sodium, potassium, manganese, iron, copper and organic matter (Subhajit Ray, 2017).

Calcium carbonate ($CaCO_3$) that composes egg shells can't react or dissociate in pure water. However it can be changed into calcium oxide (CaO) by a process called calcination. Calcium oxide is a quick lime, very stable compound, and can form a slaked lime in the presence of water. It is extensively used for medicinal purpose (Tangboriboon, 2012) .

Calcium ions in solution are better than calcium tablets for the human body. They are already dissociated into ions and easy to swallow it than calcium tablet

Recommended Dietary Allowance for calcium in mg/day according to Surgeon (2004):

Life stage group	Calcium mg/day
0–6 months	210
7–12 months	270
1–3 years	500
4–8 years	800
9–13 years	1300
14–18 years	1300
19–30 years	1000
31–50 years	1000
51–70 years	1200
> 70 years	1200
Pregnancy:	
<18 years	1300
19–30 years	1000
31–50 years	1000
31–50 years	1000
Lactation:	
<18 years	1300
19–3 years	1000
31–50 years	1000

Table 2- Recommended dietary allowance for calcium in mg/l

II. HYPOTHESIS

- Egg shells are a source for obtaining calcium ions naturally.

III. METHODS

Materials: Chicken Egg Shells, Coal, Labor photometer, lemon juice, Drinking water, beaker (500 ml), spatula, digital balance, graduated cylinder (10ml,300ml), watch glass.

Procedure:

a. Experiment 1:

Raw chicken egg shells were collected. The egg shells were washed with tap water until the white membrane was completely removed then dried at room temperature. After that the egg shells were crushed into a powder, and kept on a filter paper at room temperature. The dried egg shells were subjected to high temperature by defacing them in burned coal for 10-15 minutes. After that 96.5 g were taken from the obtained powder using spatula watch glass and digital balance and were inserted in a 300ml beaker. 10 ml of lemon juice and 300 ml of distilled water were measured using graduated cylinder, and then added to the powder in the beaker. Finally take 10ml from the prepared solution, insert them in the labor photometer to measure the

amount of calcium ions in the solution and record the result.

b. Experiment 2:

Take 10ml of drinking water and insert them in the labor photometer and record the result.

IV. RESULT

The concentration of calcium ions in 10ml of prepared solution is 240mg/l

Doc-1 value of mass concentration of calcium ions in the prepared solution using labor photometer

The concentration of calcium ions in 10ml of drinking water is 160mg/l

Doc-2 value of mass concentration of calcium ions in drinking water using labor photometer

Each 96.5g of $CaCO_3$ and 10ml of lemon juice give 240 mg/l, [m=C×V] 240mg of calcium ions in 1 liter. To increase the quantity needed according to the age and the case in order to obtain regulated solution the relation will be

$$[X=\frac{Y \times 96.5\ g}{240\ mg}]$$

X: mass of calcinated egg shells in g
Y: [mass of calcium ions needed – 160mg]

V. CONCLUSION

The egg shells are major source of calcium and according to the result using calcinated egg shells increases the concentration of calcium ions in drinking water by 240 mg/l.

VI. ACKNOWLEDGMENT

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