CORAL-CALCIUM FROM THE BLEACHED CORAL OF MADAGASCAR

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ABSTRACT

Insufficient food is inevitable in Madagascar, more than 80% of the population live in poverty. However, the island is rich in biodiversity that could be used as a food supplement. Corals are generally found in the southwest part, as well as the eastern part of the island; they are distinguished from other natural corals thanks to the abundance of minerals present. In addition, the beaches of the southwest and east parts of Madagascar are polluted by bleached coral, brought by the waves. In order to avoid dietary deficiency and the high costs of pharmaceutical products, we want to make use of the exoskeleton of these hard corals of Madagascar which is composed of 91.5% of CaO including 65.36% of calcium and 0.21% magnesium. The objective is to develop an organic food supplement based on hard coral from Madagascar, in the form of effervescent tablets, this against calcium and magnesium deficiency at lower prices. A methodological approach was implemented for the development of this product followed by a comparative study of the solubility in water by conductimetry of coral-calcium, of the pharmaceutical product UPSA-C calcium, of the product Merck $CaCO_3$. The product would have a very beneficial impact on the developing country. Thus, bleached coral from Madagascar can be an alternative against calcium and magnesium deficiency.

Keywords: *coral, calcium, magnesium, nutrition, solubility, Madagascar.*

1. INTRODUCTION

Developing countries are faced with the problem of calcium and magnesium deficiency, in addition the cost of pharmaceutical products for the dietary supply of calcium and magnesium is exorbitant: cost of pharmaceutical products for the supply of calcium: UPSA-C calcium: Ar 19 000, Ca-Sandoz: Ar 22 000 and magnesium: magnesium-B6: Ar 24 000.

As 80% of the Malagasy population live in poverty, pharmaceutical treatments based on calcium and magnesium remain a luxury. However, we see that in the marine coral of the island, these elements are very abundant, especially from their exoskeleton.

In order to avoid dietary deficiency and the high costs of pharmaceutical products, it is important to use the exoskeleton of the coral of Madagascar, a food supplement rich in calcium and magnesium as well as the development of a coral-calcium.

Our study aims to develop the coral of Madagascar in order to prepare a coral-calcium based on coral of pharmaceutical quality [1].

Indeed, the supply of food nutrition in calcium and magnesium elements is essential especially in strengthening the body.

The element calcium is involved in:

-the phenomenon of Osteogenesis: bone tissue is made up of $Ca_3(PO_4)_2$ [2]

-the nervous system.

-blood clotting: the blood contains approximately 75 to 160 mg of calcium per liter, which helps stop the bleeding.

-regulation of the organism: enzyme activation [3].

The element magnesium, which our daily needs are 350 to 480 mg / day, is involved in:

-nervous balance: the nervous system is dependent on the calcium / magnesium balance.

-all the biochemical processes of our organism: synthesis of nucleic acids and proteins, cell production …
-treatment of: thrombosis: it activates the thrombocyte.
-cancer treatment: it activates the phagocytic power of leukocytes [4].
Hard coral is surrounded by an outer skeleton (rich in calcium carbonate) that it builds up as it grows. They usually live in colonies and form coral reefs. Sometimes pieces of the reef break away from the colony and migrate to the bottom of the sea where they fossilize [5]. In addition, Madagascar is a maritime country with one of the largest coral reefs in the world, in the eastern and southwestern part of the island [6].

1.1. Solubility of coral

Studies report that: taken orally, coral calcium is better absorbed than other sources of calcium, especially because of the presence of other trace minerals [7]. It is therefore 100% absorbed in 20 minutes [8].
The normal pH level for a healthy body should be between 7.35 and 7.45. When the body's pH becomes acidic, it means that there is a lack of oxygen in our cells. This lack of oxygen leads to disease and accelerates aging. From this point of view, researchers have found that coral balances the pH, which strengthens and revitalizes tissue cells, while helping to reduce the risk of degenerative diseases [8].

1.2. Chemical composition and structure

The chemical composition and structure of the coral is:
-Mineral elements: calcium carbonate, magnesium, copper, nickel, strontium, zirconium, palladium, iron.
-Organic elements: aspartate, glutamate, glycine, proline and many other trace elements in small amounts.
Madagascar coral is 91.5% CaO (65% calcium) crystallizing in an aragonite form, with an orthorhombic crystal system [9].

1.3. Comparative study of Madagascar coral

The research would be shown in Table 1, in order to compare the coral from Madagascar to the coral from the literature review [9].

Table-1: Comparison between coral from Madagascar and foreign coral

Chemicals elements	**Madagascar coral in%**	**Foreign coral in%**
Calcium	65.36	38
Magnésium	0.205	0.05 à 0.2
Strontium	2.39	0.5 à 0.9
Copper	0.21	0.001
Iron	0.47	0.003
Nickel	0.07	0.005

According to Table 1, the corals of Madagascar do not contain toxic elements such as: lead, arsenic, chromium, cyanide, mercury, cadmium, barium, nitrate.

2. MATERIALS AND METHODS

2.1. Study zone

Coral is present in Madagascar in the eastern part and in the south-western part.

2.2. Coral-calcium manufacturing

The steps to follow for the manufacture of this organic product based on bleached coral:
-Rinse, the corals and boil them for 10 minutes to eliminate germs and other bacteria.
-Drying, on a drip pan then baking at 90 ° C for 10 minutes.
The goal is to use the coral calcium (calcium carbonate) to have the active ingredient which is calcium. To know the amount of calcium carbonate to use, take for example the amount needed to make a 1000mg tablet of calcium for an individual of 4 to 8 years old and 19 to 50 years old, each class of individual has its own intake of calcium. calcium, [10].
-Grinding: Grind the coral either using one of the old-fashioned preparation methods or using a grinding machine. -Weighing: after grinding, it is necessary to weigh 1399.93 mg of $CaCO_3$ to have 1000 mg of calcium in a tablet; as well as the various excipients. The precision of this weighing is of great importance so it is important to respect it.
-Mixture: active ingredient and excipient.
The excipient, they mean a substance that is not active. Its role is all the same important since an excipient is intended to give specific characteristics to the product of which it is a component: a consistency, a taste, etc. All while avoiding chemical interactions, in particular with the main active ingredients [11].
Citric acid and sodium will be responsible for the effervescent effect of the tablet while aspartame and sorbitol will be responsible for the taste.
-Compression: after mixing, compress everything using an alternative tablet machine [12].
-Packaging: boxing of the organic product This sums up the mechanism performed to obtain a 1000mg calcium tablet.

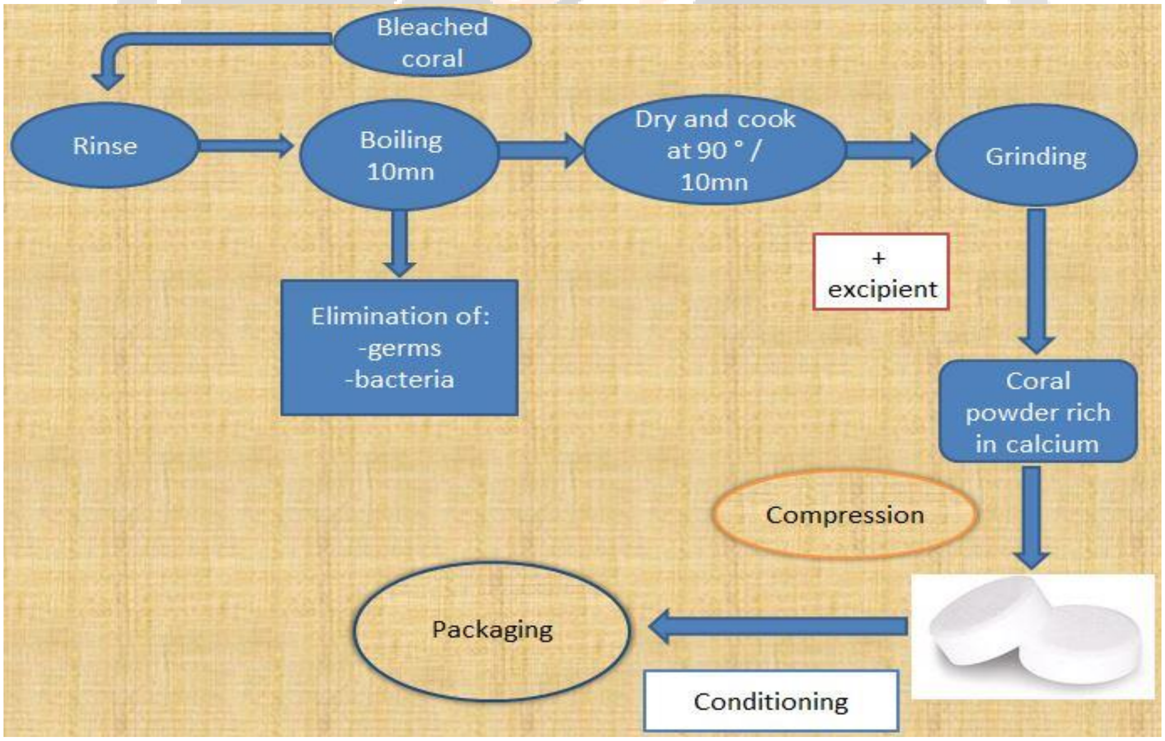

Fig-1: Manufacturing steps

However, we can combine certain compounds like vitamin D to make our tablet more active because vitamin D allows maximum absorption of calcium into the bones.

2.3. Solubility by conductimetry

The conductivity of a solution is the conductance of a column of solution between two metal electrodes with a surface area of $1cm^2$ and separated from each other by 1cm.
The measurement is based on the Wheatstone Bridge principle, using as a device a conductivity meter, Model 1484-11 Conductivity Metter, Cole-parmer instrument company, 7425 North Oak Park Avenue Chicago Illunois 60648-U.S.A.
A cell made up of two square blades of 1cm side, in platinum-coated platinum, kept parallel in a glass tube, at a distance of 1cm. When the device is immersed in the solution, a column of liquid with a cross section of $1cm^2$ and a length of 1cm is thus defined [13].

3. RESULTS AND DISCUSSIONS

3.1. Coral-calcium

After different calculations and following these manufacturing steps, we arrive at an organic product of 1g in the form of an effervescent tablet with the following composition:
Active ingredient:

- 1000 mg of Calcium from $CaCO_3$
- Magnesium: 2.95 mg

Excipients:

- Citric acid
- Aspartan (E951): 17.5 mg
- Sodium: 0.098mg
- Sorbitol (E420): 1.15g.

Fig-2: Effervescent tablets

3.2. Results on the solubility of this product

After reading directly on the device, the conductivity of a prepared solution of the organic product is ν = 5.67µS/cm, which is the average of the three measurements ν_1 = 5.6µS/cm, ν_2 = 5.7µS/cm, ν_3 = 5.7µS/cm with a standard deviation of $\sigma(x) = 0.048$.

3.3. Discussions

The comparative study of the solubility of the organic product compared to pharmaceutical products is given in Table 2.

Table-2: Results of the electrical conductivity measurement

Solutions to study	Electrical conductivity (ν)	Standard deviation : σ (x)
Calcium carbonate solution (Merck product)	ν_1 = 2,6µS/cm ν_2 = 2,7µS/cm ⇨ ν = 2,67µS /cm ν_3 = 2,7µS/cm	σ (x) = 0,048
Coral-calcium solution	ν_1 = 5,6µS/cm ν_2 = 5,7µS/cm ⇨ ν = 5,67µS/cm ν_3 = 5,7µS/cm	σ (x) = 0,048
UPSA-C calcium solution	ν_1 = 48µS/cm ν_2 = 47µS/cm ⇨ ν = 47,33µS/cm ν_3 = 47µS/cm	σ (x) = 0,471

Before entering the comparison of our three solutions, let us first remember that these solutions were prepared from distilled water of very low conductivity which can be explained by the partial distillation of water with fraction in ions H_3O^+ and OH^- only.
From the results on electrical conductivity, we find that:
The conductivity of the $CaCO_3$ / Merck product solution slightly exceeds that of distilled water, but still remains low which results in a very low amount of ions in the solution.
The conductivity of the coral-calcium solution is twice that of distilled water, which means that in addition to the partial distillation of distilled water with fraction of H_3O^+ and OH^- ions, there are d 'other foreign bodies such as: Ca^{2+}, Mg^{2+}.
The conductivity of the UPSA-C / calcium solution is significantly higher than the two previous solutions, this is due to the presence of very soluble organic compounds and in large quantities in UPSA-C. In addition to the H_3O^+ and OH- ions in distilled water, there are therefore the ions: Ca^{2+}, Mg^{2+}, Na^+, Cl^-, SO_4^{2-}, HCO_3^-, …
It is also noted that the resistivity of calcium carbonate / Merck product is low compared to that of coral, which shows that coral from Madagascar is more soluble than calcium carbonate in water.

4. CONCLUSIONS

The use of coral-calcium made from bleached coral from Madagascar is found to be an alternative for strengthening the body's immunity. So we have developed a food supplement to solve the deficiency in calcium and magnesium. Then the study made it possible to show that the calcium carbonate of the organic product is much more soluble than the calcium carbonate present in other pharmaceutical products, so it is more assimilable by the body compared to pharmaceutical products already existing on the markets. medication. And it should be noted that the organic product does not present toxic elements since the coral of Madagascar does not contain poisonous elements such as: lead, arsenic, chromium, cyanide, mercury, cadmium, barium, nitrate. This study therefore has a great interest in public health, hence the need to implement it as quickly as possible for the good of the country.

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