

# Cross-linked natural gum resins, when inserted in shampooing product, result infallible to eliminate several metallic ions risky for hair keratin

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## ABSTRACT

Aims of my research is to herald the method of eliminating Calcium and Magnesium ions that remain onto hair and scalp keratin after washing with common hard water and trivial shampooing products, but even of removing other metals as Lead, Silicon and Nickel ions which can be retrieved in manifold building materials like mortar, cement, concrete, pozzolans, limestone and asbest, most of workers throughout the world are directly involved with, because of their continuous contact with those chemical materials. I have selected twelve volunteers (workers who are directly in contact with building materials containing Calcium and Magnesium ions) and prayed them to use three types of shampooing products of my invention (containing special gum resins previously cross-linked in order to uptake or sorption the metallic ions) after having used, in precedence, trivial shampoos (bought at the same store) and used the same tap water, since they live all in the same town. I calculated the difference of quantities of Magnesium and Calcium that remain onto hair and scalp keratin, using a general and trivial shampoo respect to my products, apt to remove the same metallic ions. Results are satisfactory and encouraging.

**Key words:** Metal uptake; Metal sorption; Cross-linked gum resins; German degrees; Water hardness

## INTRODUCTION

Aims of my research is to devise the way of eliminating Calcium and Magnesium ions that remain onto hair and scalp keratin after washing with common hard water and trivial shampooing products, but even to build up a rigorous method to totally remove the same Calcium, Magnesium and too often Lead, Silicon and Nickel ions as well from all the total hair of whichever worker who is occupationally involved with the direct and customary contact with mortar, cement, concrete, pozzolans, limestone and asbest, keeping on account that except the following countries: Algeria, Argentina, Australia, Austria, Bahrain, Belgium, Brunei, Bulgaria, Chile, Croatia, Cyprus, Czech Republic, Denmark, Egypt, Estonia, Finland, France, Gabon, Germany, Greece, Honduras, Hungary, Iceland, Ireland, Israel, Italy, Japan, Jordan, Korea (South),

Kuwait, Latvia, Lithuania, Luxembourg, Netherlands, New Caledonia, Norway, Oman, Poland, Portugal, Qatar, Romania, Saudi Arabia, Serbia, Slovakia, Slovenia, South Africa, Spain, Sweden, Switzerland, Turkey, United Kingdom and Uruguay where asbest has been banned since long time, manifold countries exist which have never abolished the use and/or production of asbest, amosite, crocidolite, tremolite, chrysotile, anthophyllite and actinolite, (for instance the exploitation of such minerals are fully allowed in the Republic of India, in the People's Republic of China, in Brazil, Republic of Mongolia, Republic of Seychelles, Singapore or Taiwan (Republic of China or Formosa) or the Democratic People's Republic of Korea, idest North Korea).

Generic mortar, after analysis according to the ASTM C1324, "Standard Test Method for Examination

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and Analysis of Hardened Masonry” appears to contain approximately 60.0% calcium oxide (CaO) and 30.0-to-15.0% silicon dioxide (SiO<sub>2</sub>). Brucite (magnesium hydroxide) has been also detected at a low amount, indicating the hydrated lime is an impure, high-calcium type.

It is well known that Calcium ion builds up on the hair, leaving the hair feeling dry and weighted down, that can even cause perms and hair sculptures to be relaxed, may cause flaking, too often as dandruff, can clog the hair at the mouth of the follicle, causing the hair to break off, and may coat the scalp, blocking further hair growth. Moreover, some Japanese researchers have recently heralded the existence of the protein S100A3, a unique protein among all members of the calcium-binding S100 family, which is specifically expressed at the inner endocuticle of human hair fibers and upon hair damage the aforementioned protein is released from hair fibers and possibly destabilizes all the hair tissue architecture [1,2].

As far as Magnesium ion is concerned, it attaches to the S-S double bond of the cysteine of hair keratin, leaving it feeling dry and weighted down. Regard to Silicon ions, it is to be stressed that all Sand-like substances can build up on hair, causing dryness, dandruff, weight, and hair loss. Effectively people native to volcanic or desert areas are well acquainted with the fact that sand silica may build up very hard, virtually insoluble deposits on all kind of natural and/or inorganic surfaces, extremely hard to be eliminated. Finally, since Nickel and lead are commonly found in cement in non-negligible concentrations, it is supervacaneous to stress the importance of attempting to remove these ions by cosmetic way from human hair.

It is mandatory to assert that all generic and trivial shampooing products, due to the presence of anionic surfactants, are capable to form aliphatic salts of Calcium or Magnesium or Silicon or Lead, which, for sake that are fully insoluble in water remain attached to hair and are prone to damage it.

So, primarily, I have decided to select twelve volunteers (masons, miners and carpenters) which are always in contact with dangerous building materials containing high percentages of metallic ions that remain inevitably onto their hair or scalp keratin.

Secondarily, I collected all the original rinsing waters of their showers or bath-foams after having used a

generic shampooing product and the same tap water, (since they live all in the same city), and the subsequent quantitative detection of the ions, objects of my investigation, by the Boutron-Boudet's idrotimetric method, reviewed by Walter and Gartner, that forecasts the successive titration by Ba(NO<sub>2</sub>)<sup>2</sup> and extrapolation of results in German degrees instead of employing the official measurement by French degrees for the evaluation of water hardness.

It is suggestive to declare that I used in my three formulas the same surface active agent that was used for the determination of the original hardness of the tap water.

Finally, the quantitative detection of the same involved ions after washing and shampooing with three different cosmetics comprising three diverse gum resins apt to uptake and/or sorption the same ions, object of this study.

## MATERIALS AND METHODS

It is necessary to explain what the Boutron Boudet's test is: it is based on the capacity Calcium and Magnesium ions that are present in the aqueous solution to create insoluble compounds when mixed together with Castile soaps (idest the savon de Castille, so called from the first Muslim soap-makers in the 12<sup>th</sup> century in Castilla (Alicante, Malaga, Cartagena) and in Italy (Naples, Savone, Genoa, Bologna and Venice) which only at the end of the 15<sup>th</sup> century was baptized Savon de Marseille in Marseille France, a worldwide famous surface active agents obtained by the neutralization of olive or laurel oil by strong aliphatic acids).

When a Castile soap solution with known concentration is added drop by drop to a known volume of deionised water and the new-formed solution is drastically agitated, a thick layer of foam appears.

Apposite Boutron Boudet's hydrotimetric bottles are used to determine the degrees that appear on the scale of the cylinder and are called French degrees, that represent indicatively the exact concentration of the Calcium and Magnesium ions pro liter of hard water, but since I use the variant of the Boutron Boudet's method, the Walter Gartner's titration by the use of Ba(NO<sub>3</sub>)<sub>2</sub>, I express the final results in form of German degrees, since I objectively used a soap deriving from an animal grease (tallow) instead of a soap deriving from the neutralization of a vegetal oil with strong aliphatic acids.

Thus, We have collected the twelve initial rinsing water samples from the 12 volunteers, by reason of 2 lt for each individual, which used the same shampooing-bath-foam purchased in the same store and employed the same tap water, since they live in the same city.

Originally We have scored the value in German degrees of the pure tap water and this value must always be obligatorily subtracted from every result, both after washing using the generic and trivial shampooing product and after washing using the three formulations I gave to the 12 volunteers to test.

We have first determined the quantity of Calcium and Magnesium in the original pure tap water using the Boutron-Boudret's method that expresses the quantity of calcium and magnesium ions in form of German degrees (1 German degree correspond to 1,25 English degrees and to 1,79 french degrees).

The result of this evaluation is 8.96 German degrees (corresponding to 12 French degrees or 16 English degrees).

Secondarily We have determined the German degrees of the 12 rinsing water samples after washing with the generic shampooing product and finally the German degrees of the 12 rinsing water samples after washing using the three formulas I gave the volunteers to test.

It must be kept on account that after every determination it is necessary to subtract the original value in German degree of the pure tap water used for washing.

We used potassium tallowate, as the anionic surfactant required to determine the total degrees of the rinsing water samples, and it can be noticed that the same potassium tallowate will be the same surfactant apt to clean and cleans human hair and scalp, comprised in the three formulas I ideated.

Several are the international patents and papers which disclose the invention of matrices or beads apt to uptake bivalent or trivalent or heavy metals from pure water to make it drinkable or just from wasted water to reuse [3-9].

We have selected three fluid matrices, where three biopolymers (gum resins) were previously cross-linked by the aids of inorganic activators, and thus:

(MATRIX ONE) A 1.5% Locust bean gum aqueous solution cross-linked by borax (2.3%) and condensed in microwave oven for 2 min (potency 200W).

(MATRIX TWO) A 2% Carrageenan acqueous solution cross-linked by Ammonium Bromide (1.4%) and condensed in microwave oven for 1 min (potency 400 W).

(MATRIX THREE) A 1.5% Tara Gum acqueous solution cross-linked by borax (2.1%) and condensed in microwave oven for 1 min (potency 400W).

These three condensed and cross-linked gum resins are able to uptake generically and indifferently Calcium, Magnesium, Lead, Silicon and Nickel ions and are inserted in cosmetic formulas that comprise the same surface agent that had been used to determine the hydrotimetric degrees (German degrees) of the rinsing water samples of the twelve workers after shampooed using a trivial shampooing product.

The following are the formulas of shampooing-bathing-foams I prepared for the volunteers.

It is important to notice that no preservatives, colours and fragrances are included, in order not to distort quantitative detections of the involved ions.

A) Matrix ONE  
Potassium tallowate  
Glycerin  
Decyl glucoside  
Sodium cocoyl glutamate.

B) Matrix TWO  
Potassium tallowate  
Glycerin  
Decyl glucoside  
Sodium cocoyl glutamate.

C) Matrix THREE  
Potassium tallowate  
Glycerin  
Decyl glucoside  
Sodium cocoyl glutamate.

In Tables 1-4 was presented list of German degrees.

## Ethics

This study was performed on human subjects; thus, all patients were aware of the presence of the study

**Table 1:** List of German degrees evaluated in the 12 rinsing waters after simplest washing with trivial shampooing products and tap water (it must be considered that some individual may present higher pools of Calcium and Magnesium ions than others, due to his contacts with chemicals during his job)

Case	A	B	C	D	E	F	G	H	I	L	M	N
German degrees	9.7	9.0	7.9	10.8	9.6	9.7	8.9	10.1	7.8	9.5	11.8	7.8

**Table 2:** List of German degrees evaluated in the 12 rinsing waters after washing with Shampooing product A containing Matrix ONE

Case	A	B	C	D	E	F	G	H	I	L	M	N
German degrees	5.0	4.1	5.6	6.1	6.2	4.9	6.0	7.0	3.9	4.8	5.2	6.1

**Table 3:** List of German degrees evaluated in the 12 rinsing waters after washing with Shampooing product B containing Matrix TWO

Case	A	B	C	D	E	F	G	H	I	L	M	N
German degrees	4.8	5.2	6.6	7.1	6.3	6.1	6.8	5.9	6.2	5.7	6.0	7.1

**Table 4:** List of German degrees evaluated in the 12 rinsing waters after washing with Shampooing product C containing Matrix THREE

Case	A	B	C	D	E	F	G	H	I	L	M	N
German degrees	3.3	4.1	5.5	3.6	4.8	3.7	7.1	4.3	5.4	6.1	3.9	5.0

and they were fully informed about the drug and its side-effects.

## RESULTS AND DISCUSSIONS

It is important to refer that I preferred to use the Raghu Raj Bahadur's statistical method that observes the Anderson-Bahadur's algorithm to calculate the final results and thus, after having had all the experimentations made from the 12 volunteers and had all the calculus realised I can absolutely assert that:

The shampooing containing Matrix A (that is locust bean gum cross-linked by borax) evokes a decrease of 41.91% of the original value measured in German degrees measured in the rinsing waters after washing with trivial shampooing product.

The shampooing containing Matrix B (that is Carrageenan cross-linked by Ammonium bromide) evokes a decrease of 32.00 % of the original value measured in German degrees measured in the rinsing waters after washing with trivial shampooing product.

The shampooing containing Matrix C (that is Tara gum cross-linked by borax) evokes a decrease of 48.66% of the original value measured in German degrees measured in the rinsing waters after washing with trivial shampooing product.

All this stands for an approval or indeed a drastic incitement to the proposal of manifold cross-linked natural gums which may be employed in cosmetics apt to wash, rinse and cleanse hair and epidermis in order

to remove and eliminate metals that are retrievable in hard waters, atmosphere and more so in cements, mortars, concretes, pozzolans, limestones and asbest.

## Statement of Human and Animal Rights

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008.

## Statement of Informed Consent

Informed consent was obtained from all patients for being included in the study.

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