



## Characteristic and Heavy Metal Study on Herbs Shampoo Containing Momordica Charantia and Hibiscus Rosa-Sinensis Extraction Formulation



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### Abstract

The entire world is currently endeavouring to return towards the natural organic materials through its side effects towards ailments. The most popular form of remedy to resolve the scalp issue, boost hair growth, and clean the hair would be through shampoo usage. However, many selected ingredients used in the shampoos sold in the market, such as formaldehyde, halogenated organic compounds, heavy metal, musk fragrances, and coarse coal tar, put many consumers at risk. This paper aims to analyze the heavy metal and characterizations of herbs shampoo containing main organic ingredients are known as Momordica charantia extract, which is rich in vitamin C and amino acids. Besides that, incorporating Hibiscus Rosa-Sinensis as one of the organic ingredients displays amazing results as a booster for hair growth. It can be observed that it helps nourish the development of collagen as it is rich in vitamin C. Meanwhile, the amino acid found could play a vital role in growing healthy locks of hair, nourishment, and as a medium to strengthen the roots. This shampoo has been formalized based on literature findings on its bioactivities and tailored to all the possible variations associated with hair quality, age, frequency of shampooing, and specific problems relating to the scalp's superficial condition. The pH is currently natural with 7.0 with viscosity 1190 cP and density 1.49 g/cm<sup>3</sup>. The heavy metal study was conducted using inductively coupled plasma (ICP-OES), and it depicts arsenic, cadmium, plumbum, nickel, chromium is not detected (<0.7 mg/kg). Lastly, for allergy patch skin test, a test was done on 21 Asian women, and no result of irritation occurs. As from the data analyzed, the formulated herbs are considered safe and ready to be commercialized as shampoo.

**Keywords:** Momordica charantia; Hibiscus rosa-sinensis; Viscosity; Patch test; Heavy metal; Herbs shampoo.

### 1. Introduction

The shampoo is defined as a product for hair care in the form of viscid liquid, where its usage is known for cleansing the hair by applying it to damp hair, rubbing the product into the hair, and finally washing it out. Today's market is filled with chemicals in the shampoos [1]. Chemicals in the shampoos are prepared with several chemicals which can cure hair problems but also they are also responsible for damaging the hair. Some international research noted that the chemical ingredients inside the shampoo are also responsible for cancer [2]. Many selected

ingredients used in the shampoos sold in the market, such as halogenated organic compounds, formaldehyde, heavy metal, musk fragrances, and coarse coal tar, put many consumers at risk.

A long term disclosure of heavy metal toxicity would cause harmful effects to consumers. Humans' vital organs could be severely affected by the accumulation of metal impurities, even at low concentrations [3]. Humans are exposed to heavy metals, mainly via ingestion and inhalation. Exposure through skin absorption also occurs from re-suspended powder particles, which come from soils [4, 5] or

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through skin contact with clothes [6]. Heavy metals such as Cd, Pb, Ni, Hg found in ingredients in developing cosmetics are forbidden under the "Guidelines for Control of Cosmetic Products in Malaysia, Annex II" because they are perceived as dangerous and harmful [7]. Given that heavy metals used as intentional cosmetic ingredients have been identified accordingly, attention is drawn to these substances' existence as debris or residue. It has been shown in Malaysia's guidelines that the existence of traces of substances recorded in Annex II shall be accepted in a condition that such presence is technically ineludible in good manufacturing practice within the regulation of Article 3 in the ASEAN Cosmetic Directive [7].

The elements of high humidity levels and temperature existing in tropical climates such as Southeast Asia countries acts as a medium for microorganisms to grow actively, such as fungi [8]. Malaysia is known as a tropical country with diverse traditional medicines. For instance, the usage of *Momordica charantia* is utilized as an antifungal. The contents such as saponin and flavonoid found in *Momordica charantia* benefit as an antifungal [9]. In preventing microbial infections activated by flavonoids composed by plants, flavonoids are acknowledged to be efficient as an antifungal. Also, the boost of cell membrane permeability through the breaking down process in the layers of fat on cell membranes could be identified by the antifungal effect of saponins [10].

The Malaysian National flower known as Bunga Raya or *Hibiscus rosa-sinensis* is widely distributed and planted worldwide. *Hibiscus Rosa Sinensis* popularized as the red Hibiscus is known for its' big shrub various structure. Different red Hibiscus structures are incorporated in Asian traditional medicine to cure many diseases by utilizing the usage of its barks, roots, leaves, and flowers. Assorted research studies demonstrated the effectiveness of different parts of *Hibiscus Rosa Sinensis* plants for several purposes: Antimicrobial, Antioxidant, Antiulcer, Antidiabetic, Antifertility, Hepatoprotective, Anti-inflammatory, and Antigenotoxic properties, which aid as a treatment of various diseases. Many herbal mix and drinks used *Hibiscus rosa Sinensis* as the red-flowered variety is ideal in medicine [11].

This study aims to characterize and evaluate the shampoo on heavy metal content made from organic

materials and main ingredients, which are *Momordica charantia* and *Hibiscus rosa-sinensis* which is cheaper, natural and has no harmful effects to the users as well as the environment.

## 2. Materials and Methods

### 2.1. Heavy metal test

The prepared shampoo was digested before characterized by an inductively coupled plasma atomic emission spectroscopy (ICP-OES) analyzer. Due to the nature of current sample matrices and digestion procedure, the operating conditions of ICP-OES spectrometer recommend for the metal in cosmetic determination were used. The chosen operating conditions were: coolant gas 18 L/min, auxiliary gas 0.5 L/min, nebulizer gas 34 psi, RF power 1.2 kW, pump rate 1.2 mL/min, sample uptake time 30 sec, integration time 30 s axial view. 0.5g of samples was weighted into the weighing cup and was put inside a reaction vessel. Nitric Acid and Hydrogen Peroxide are added into the sample vessel, and the sample was digested using a microwave digester. The samples were allowed to cool down and top up the digested solution to a volume. After it was ready, the samples were analyzed using ICP-OES model Optima 8300B. Standard solutions of plumbum, cadmium, chromium were prepared from 1000ppm standard stock solution of GFS Fishers' AAS Reference Standard. These stock solutions were serially diluted to given concentrations of; 0, 0.05, 0.1, 0.15 ppm for mercury standards while 0, 2, 4 and 6 ppm for lead, 0, 0.1, 0.2, 0.3, 0.5ppm for cadmium and 0, 0.5, 1.0 and 1.5 ppm for chromium standards. The result was read and recorded according to method AOAC 968.08.

As for arsenic and nickel, two grams (2 g) of each of the samples were digested by pouring it into a flat bottom flask followed by 20 mL of the acid mixture. The flat bottom flask was corked and heated on a hot plate inside a fume cupboard until the solution became clear. The digest was diluted with 250ml of distilled water, filtered and 100ml of the filtered solution was used for the ICP-OES analysis. The result was read and recorded according to method USEPA 6010B and USEPA 200.8, respectively.

### 2.2. Allergy Patch Skin Test

Twenty-one volunteers who are Asian women undergo a patch test to test the allergies towards the shampoo. The shampoo sample covered with a patch

was placed under the volunteer elbow, chin, and behind the ears for 24 hours. The volunteers need to respond if there is a sign of allergies such as rash, itching, redness, swelling, and burning feeling.

### 2.3. Viscosity Test

The liquid shampoo's viscosity is determined using Brookfield digital viscometer (model DV-11+) and referring to ASTM D 1084 as the standard method for this test. 150 ml of the shampoo is taken in a beaker, and the spindle is dipped in it for around 4 to 5 minutes range, and lastly, the reading is recorded. The dynamic viscosity measurement in unit cP, also called centiPoisles was used in the viscosity measurement method.

### 2.4. Density Test

A density test was conducted using a density cup stainless steel model Elcometer 1800. The empty cup was weighted and filled up with a sample. Next, the lid was placed on the cup, and excess shampoo was removed before the final weight. The density was calculated using the formula weight divide by its unit volume.

## 3. Result and Discussion

The herbal shampoo is studied as an alternative to commercialized synthetic shampoo. However, practicing formulating cosmetics by utilizing entirely natural raw material ingredients is hard due to cost, effectiveness, and methodology [12]. A heavy metal test was done to ensuring safe levels of the ingredients in these products. Appropriate protocols digested the developed liquid shampoo sample, and the composition of heavy metals are examined, quantified using ICP-OES. The analysis depicts the noticeable amount of such elements were present in the test samples. Table 1 depicts the result for Cr, Pb, Ar, Ni, Cd.

Table 1. Result of heavy metal analysis.

Parameter	Method	Results (ppm)	Standard Deviation
Arsenic, As	ICP-OES	<0.5	0.04
Cadmium, Cd	ICP-OES	<0.5	0.09
Plumbum, Pb	ICP-OES	<0.5	0.06
Nickel, Ni	ICP-OES	<0.5	0.05
Chromium, Cr	ICP-OES	<0.7	0.10

\* (Abbreviations: ppm: part per million)

Pb, Ar, Ni, and Cd, are exceptionally toxic with a wide variety of chronic health side effects, while Cr is

a well-known skin sensitizer. The high value of Cr compared to other heavy metals, may be attributed to the plant's herb itself, Malaysian Momordica Charantia and Hibiscus Rosa-Sinensis. Cr accumulates mainly in roots and shoots, and plants absorb it through carriers of essential ions such as sulfate. Cr uptake, translocation, and accumulation rely upon its speciation, which also habituates its toxicity to plants. The concentration amount of Cr in the soils may differ remarkably according to the natural composition of rocks and sediments that compose them [13]. As compared with the 26 commercialized brand shampoo in market, analyzed by Nigerian researcher, nine concentration of heavy metal were tested, and the value of the heavy metal is above 2 ppm for Cd, Pb, Ni, and no test result for Cr and Ni were done by any researcher [14]. For these toxicity causes, commercialized shampooing manufacturing has become a reason for increased regulatory scrutiny worldwide.



Fig. 1. Evaluation of the herbs shampoo.

Figure 1 depicts the herbs shampoo's appearance, and its pinkish color may result from the extraction of Hibiscus Rosa-Sinensis. It is easily washable, and no separation of the ingredients occurs after the stability test was done in an oven at 60 °C for a week. There is no sign of rashes, itching, redness, swelling, or burning feeling for the allergy skin test. The test was done only after the heavy metal is tested below and at the neutral pH. The result was depicted in table 2. The allergic response due to chromium contamination includes serious redness and swelling of the human skin. Food and drug administration (FDA) has published draft guidance for the industry that recommends a maximum level of 10 ppm for the lead as impurity safety levels in cosmetics. Thus, the heavy metal content from the novel herbs shampoo is far from the safety level provided. A small amount of Sodium Benzanoate was added as a preservative, and pH was adjusted with citric acid and distilled water to ensure that the pH is at a neutral point. Viscosity is a

measurement of fluid friction where the higher the viscosity, the thicker the shampoo and its interfacial tension. The pH was controlled at point 7, whereas the result for viscosity is 1190 cP and density is 1.49 g/cm<sup>3</sup>. Figure, and table captions should be 9-point Times New Roman, boldface and non-italic. Initially capitalize only the first word of the caption. Figure captions are to be below the figures, and Table titles are to be fully justified right and left above the table.

Table 2. Result of allergy patch skin test on 21 Asian women.

Allergy	Rashes	Itchin	Redness	Swelling	Burnings
Result	No	No	No	No	No

#### 4. Conclusions

The preparation of organic shampoo from *Momordica charantia* and *Hibiscus rosa-sinensis* were evaluated and showed a relatively low sign of heavy metal concentration. The research showed that the shampoo complies with the regulations and suitable for consumers because it has been tested clinically and dermatologically study prove on 21 volunteers, and as a result, it shows excellent skin and hair compatibility on Asian people. Further study on identifying other traces on heavy metal is recommended to improve its quality and safety.

#### 5. Conflicts of interest

“There are no conflicts to declare”.

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