

# Scientific research on natural heavy metal chelators: testing what works

## Abstract

**Introduction:** There are a number of reports in the literature that discuss the heavy metal chelation properties of various natural substances<sup>1-7</sup> Many of these have never been tested systematically using the “gold standard” methodology of the double-blind, placebo controlled trial.

Our research group were commissioned by a Russian metal foundry to examine the chelating effects of these natural substances, and attempt to identify a natural compound that would be effective at chelating a number of toxic metals from Russian metal foundry workers.

**Design, methods and analysis:** This was a randomised, double-blind, placebo controlled trial with 350 metal foundry workers using a number of natural substances purported in the literature to chelate heavy metals. Adult males aged 18–60years old were randomly allocated to various groups taking a number of natural substances to determine their chelating potential for heavy metals. Each of these groups consisted of a control as well as an experimental group. ICP-MS pre- and post- analysis of urine, blood and hair samples was carried out over a 3-year period.

**Discussion:** This trial was designed to find the best natural compound that can be safely used for chelating men working in environments that are toxic with heavy metals. If successful, this researched natural compound may play a significant role in the treatment, prevention and general well-being of people working in toxic environments such as metal foundries and other industries with toxic by-products in the environment.

**Keywords:** heavy metals, toxic metals, natural oral heavy metal chelators, metal detox, mercury detox, heavy metal detox, toxic metal detoxification

## Introduction

Environmental pollution is very prominent in point-source areas such as mining, foundries and smelters, and other metal-based industrial operations.<sup>8</sup>

## Background and rationale

The main rationale and objective of this research was to identify effective natural heavy metal chelators that can be safely used by people that have varying degrees of heavy metal toxicity. To date, the research in this field of natural chelators has been methodologically weak and scant.

## Objectives

Over a period of three years, a number of natural substances were tested using double blind, placebo controlled trials. Over this period, natural compounds were identified that could safely and effectively chelate heavy metals from people that had accumulated high levels of these metals from their working environment.

## Trial design

Pre and post urine and faeces tests were conducted on all these natural compounds using ICP-MS spectrometry.<sup>9</sup>

## Methods and analysis

### Study setting

The research study involved the participation of a group of medical doctors from a local Russian hospital who also formed the

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ethics committee. There were also a group of analytical chemists from the plant, a group of nurses, translators, secretaries, administrators and other experts in analytical chemistry that took part in the research over the three-year period.

## Subjects

All subject participation was on a voluntary basis, each person signed a Consent Form, which had clear criteria for participation in the research. There was a sample of 347 men, aged between 18–60years old that took part in all the trials.

## Natural substances analysed

In total, there were 14 different natural substances and combinations of these that were tested. The natural substances tested were as follows:

- i. Chlorella pyrenoidosa
- ii. Homeopathic Chlorella
- iii. Cilantro tincture
- iv. Chlorella Growth Factor
- v. Homeopathic DMSA
- vi. PleoChelate (a German homeopathic)
- vii. Homeopathic Chlorella+Chlorella Growth Factor (CGF)+Cilantro
- viii. Homeopathic Chlorella+Chlorella Growth Factor (CGF)+Cilantro+PleoChelate

ix. Homeopathic Chlorella+Chlorella Growth Factor (CGF)+Cilantro+PleoChelate+Homeopathic DMSA	48hours while taking the natural substance in question, due to the slower transit time. Pre and post levels of faeces samples were also compared and statistically analysed.
x. Cilantro paste (not tincture) with vitamin C	Immediately after the trials, blood samples were taken from all the participants and analysed for a number of liver and kidney function tests to determine whether the detoxification organs were being stressed with the natural chelating compounds used.
xi. Cilantro paste, vitamin C and homeopathic lead	All the participants were given time off work during the trials as it was important for them not to continue being exposed to the heavy metals during the pre-post testing period.
xii. Cilantro paste, vitamin C and homeopathic arsenic	There were however two workers in the sample who continued working during the trial due to work pressures.
xiii. Cilantro paste, vitamin C and homeopathic cadmium	After the baseline urine samples were collected for 24hours as well as the faeces, as soon as the need arose, each participant was given their precise detoxification remedy, which they began to take three times per day (see Treatment Protocols below).
xiv. Cilantro paste, vitamin C and homeopathic antimony	All participants took certified metal-free, high-grade cell-decimated Chlorella tablets <sup>12-16</sup> (500mgx3 daily), in order to prevent the reabsorption of metals from the gut due to the high levels of toxic metals that were measured in these workers. This was an added precaution to prevent any adverse reactions.

## The research design

### Initial screening for toxicity

In order to initially determine the levels of toxicity and the specific heavy metals that were common to the metal foundry, a convenient and cost-effective screening method was used known as Tissue Hair Mineral Analysis (THMA).<sup>10</sup> Of the total number of over 2,000 employees from the metallurgical smelting plants (most toxic areas), a random sample of 374 (18.7%) were chosen to undergo a Tissue Hair Mineral Analysis (THMA)<sup>11</sup> at a reputable laboratory in the USA.

### Samples tested

Pubic hair was chosen as this is less exposed to environmental pollution from the plant and was sent to the laboratory and analysed for 8 different types of heavy metals, namely Antimony (Sb), Uranium (U), Arsenic (As), Beryllium (Be), Mercury (Hg), Cadmium (Cd), Lead (Pb) and Aluminium (Al). There were also a further 15 minerals analysed.

The four main metals that were common to all the workers were antimony (Sb), arsenic (As), cadmium (Cd) and lead (Pb), which were at very high levels. These metals were the ones chosen for further study, as they were the main by-products of the metal foundry's manufacturing process. Mercury was not really an issue as Russians do not use amalgam fillings, but gold alloys, and seldom eat fish.

### Research design

The research design was a double blind, placebo-controlled study—neither did participants, researchers nor the analytical chemists doing the spectrometry analysis. Know which treatment protocol each participant belonged to. The coding was stored in the coordinators safe until it was time to interpret the statistical data.

## The research method

### Testing methods

A baseline pre-urine sample was collected over 24hours in a 2-litre plastic container designed for such urine collection. After mixing thoroughly, a 50ml sample of this urine was collected and sent to certified laboratories in the USA for testing using ICP-MS analysis. The subject was then given another 2 litre container and began taking the natural substance that was being tested. This they took three times daily in the dosages stated below, while continuing to collect all urine over 24hours. A further post-sample was sent to the same laboratory and the levels of the pre- and post-urine samples were compared.

In order to determine the route of elimination (biliary vs urinary), the same was done for each subject but pre- and post-faeces samples were collected and sent to the same laboratory—this was done over

48hours while taking the natural substance in question, due to the slower transit time. Pre and post levels of faeces samples were also compared and statistically analysed.

Immediately after the trials, blood samples were taken from all the participants and analysed for a number of liver and kidney function tests to determine whether the detoxification organs were being stressed with the natural chelating compounds used.

All the participants were given time off work during the trials as it was important for them not to continue being exposed to the heavy metals during the pre-post testing period.

There were however two workers in the sample who continued working during the trial due to work pressures.

After the baseline urine samples were collected for 24hours as well as the faeces, as soon as the need arose, each participant was given their precise detoxification remedy, which they began to take three times per day (see Treatment Protocols below).

All participants took certified metal-free, high-grade cell-decimated Chlorella tablets<sup>12-16</sup> (500mgx3 daily), in order to prevent the reabsorption of metals from the gut due to the high levels of toxic metals that were measured in these workers. This was an added precaution to prevent any adverse reactions.

The placebo group also took this chlorella. The results indicated that the chlorella by itself was not chelating metals per se. High impact jet-spray drying that pulverizes the algae wall breaks the Chlorella cell walls, making it into cell-decimated chlorella.<sup>17</sup> The pulverizing helps to increase absorption of its vital nutrients.

Furthermore, all the homeopathic homaccords used in the study were prepared by a reputable homeopathic pharmacy in the UK.

### Statistical analysis

Statistical analysis was conducted using the Statistical Package for the Social Sciences (SPSS).<sup>18</sup> A biostatistician was responsible for running all the analyses using ANOVA, Pearson's correlation coefficients and other descriptive statistics.

### Natural substances trials

Over the three years there were a number of trials conducted using 14 different natural substances and combinations of these, that the literature purported as being effective chelators. All the 374 workers that were initially screened using the THMA took part in at least one of these trials. The various substances and their combinations tested in the trials consisted of the following—the dosages of each are mentioned in the results section—below:

- i. Placebo or Control Group—taking only water with a little cognac added to mask the taste.
- ii. Homeopathic Chlorella Group—this consisted of a homaccord of homeopathic chlorella ranging from 6c to 30c.
- iii. Cilantro Group<sup>19</sup>—taking Cilantro or Coriandrum sativum leaf tincture.
- iv. Chlorella Growth Factor, taken alone.
- v. Homeopathic DMSA, using a homaccord of homeopathic DMSA of 6c to 30c as a tincture.

- vi. PleoChelate<sup>20</sup>—a ready-made remedy prepared by Sanum-Kehlbeck, GmbH & Co, purported to chelate metals. It consists of minerals in homeopathic dosages of D2 in water.
- vii. Homeopathic cell-decimated Chlorella+Chlorella Growth Factor (CGF)+Cilantro in the form of organic coriander sativum leaf tincture.
- viii. Homeopathic cell-decimated Chlorella+Chlorella Growth Factor (CGF)+Cilantro in the form of organic coriander sativum leaf tincture+PleoChelate.
- ix. Homeopathic cell-decimated Chlorella+Chlorella Growth Factor (CGF)+Cilantro in the form of organic coriander sativum leaf tincture+PleoChelate+Homeopathic DMSA (homaccord 6c, 12c and 30c).
- x. Cilantro and vitamin C<sup>21,22</sup> together. Cilantro paste (see below) was taken at a dosage of one tablespoon daily with 2grams of vitamin Cx3 times daily.
- xi. Cilantro, vitamin C and homeopathic lead, arsenic, cadmium and antimony (homaccords of 6c to 30c). The homeopathics were taken separately as individual homaccords such as plumbum (60dropsx3 daily) concomitantly with the Cilantro paste (See below) and the vitamin C (dosage of 5grams by 2times daily).

## Results

### Summary of the results of the natural compounds tested

The data presented in Table 1 (N=220) shows the success (✓) or failure (✗) of these trials using the above-named natural substances. Success meant that there was an increase in the specific metal in the post-testing, compared to baseline for the group being tested as a whole. To be considered a “successful” remedy (✓) it must have shown the ability to eliminate metals in ALL the people involved in the particular trial.

**Table I** The effectiveness of different natural compounds tested (N=220)

Natural compounds used	Pb	Pb	Cd	Cd	Sb	Sb	As	As
	U	F	U	F	U	F	U	F
Placebo or Control Group	✗	✗	✗	✗	✗	✗	✗	✗
Chlorella Growth Factor	✗	✗	✗	✓	✗	✗	✗	✗
PleoChelate	✗	✗	✗	✗	✗	✗	✓	✗
Homeopathic DMSA	✗	✗	✗	✓	✗	✗	✗	✗
Cilantro Tincture	✗	✗	✗	✗	✗	✗	✗	✗
Homeopathic Chlorella	✗	✗	✗	✗	✗	✗	✗	✗
Homeopathic Chlorella + CGF + Cilantro (HMD™)	✓	✓	✓	✓	✓	✓	✓	✓
Homeopathic Chlorella + CGF + Cilantro + PleoChelate	✗	✗	✗	✓	✗	✗	✗	✓
Homeopathic Chlorella + CGF + Cilantro + PleoChelate + Homeopathic DMSA	✗	✗	✗	✗	✗	✗	✗	✗
Cilantro Paste + Vitamin C	✗	✓	✗	✓	✗	✗	✗	✗
Cilantro + Vitamin C + Homeopathic Plumbum	✓	✗	✗	✗	✗	✗	✗	✗
Cilantro + Vitamin C + Homeopathic Arsenicum	✗	✗	✗	✗	✗	✗	✗	✗
Cilantro + Vitamin C + Homeopathic Antimonium	✗	✗	✗	✗	✗	✗	✗	✗
Cilantro + Vitamin C + Homeopathic Cadmium	✗	✗	✓	✗	✗	✗	✗	✗

U, urine; F, faeces

The results of the various trials over the 3-year period can be summarized below—there were a total of 220 people that took place in these trials:

**Chlorella growth factor**<sup>23</sup> by itself was only effective at eliminating cadmium in faeces at a dosage of 40 drops x 3 daily. The post-faeces sample had 150% more cadmium than the baseline sample.

**PleoChelate**, a homeopathic mineral compound produced by Sanum-Kehlbeck in Germany that is used by many Biological Medicine specialists was effective at chelating arsenic in urine only. The dosage was 60 dropsx3 daily and there was an average of about 500% increase of arsenic in the post-urine test, compared to baseline.

**Homeopathic DMSA**, used at 50 drops x 3 daily, showed elimination of cadmium in faeces (400% increase) and arsenic in urine (1,200% increase).

**Cilantro tincture** (60dropsx3times daily). This was the only natural substance used that showed a strong percentage decrease of metals in the post-urine and faeces, compared to baseline. The levels were consistently around 90–100% decrease in metals for all the metals tested. This consistency and repetitiveness in results is indicative that the Cilantro tincture is probably pushing toxic metals back into the cell. One hypothesis to explain this phenomenon would be that when Cilantro is used alone it is probably removing metals intracellularly into the mesenchyme, but as there are no other chelators to attach to the metals in the mesenchyme, through the law of osmosis (higher concentration to lower concentration) the metals are being reabsorbed back into the cell. The body is therefore withholding more metals than the baseline or pre-provocation sample. This “osmotic backlash” could prove detrimental for a severely toxic person with chronic disease, particularly neurological diseases.

Homeopathic Chlorella at potencies of 6c to 30c did not eliminate any of the metals in the post-provocation test.

Cilantro, vitamin C and homeopathic lead, arsenic, cadmium and antimony (homaccords of each homeopathic from 6c to 30c). Each homeopathic would chelate and eliminate the metal that represented it, so plumbum would chelate lead, arsenic homeopathic would chelate arsenic and so forth.

Homeopathic Chlorella Homaccord, CGF and Cilantro compound that is now known as HMD™ showed the most promise as it eliminated ALL the metals tested, both through the urinary as well as the biliary route. The results for this compound are shown in Table 2—both for the urine and for the faeces samples. The elimination of the four metals is compared to the placebo trials. Once it was established that the homeopathic Chlorella+Cilantro+CGF was the most promising compound, this was further tested amongst 84 foundry workers to determine the exact percentage of each substance in the compound, as well as the dose that was most effective for each of the metals tested.

**Table 2** Test results of the natural compound HMD™ - number of trials over a 3-year period

HEAVY METALS TESTED	Mean % increase after provocation	Mean % increase of Placebo	Number in sample	Results on statistical test	Degrees of Freedom	Level of Significance
ARSENIC-U	7409%	11.16%	84	-	-	p<0.0005
ARSENIC-F	59.83%	61.13%	84	-	-	p<0.05
LEAD-U	466.47%	-16.95%	84	-	-	p<0.005
LEAD-F	142.16%	-6.01%	84	-	-	p<0.05
CADMIUM-U	67%	-27.91%	84	-	-	p<0.05
CADMIUM-F	43.13%	22.62%	84	-	-	p<0.05
ANTIMONY-U	59.16%	14.91%	84	-	-	p<0.05
ANTIMONY-F	50%	6.61%	84	-	-	p<0.05
NICKEL-U	80%	5.52%	77	t=1.425	76	p<0.158
BISMUTH-U	564%	7.95%	19	t=2.109	18	p<0.04
URANIUM-U	707%	18.23%	76	t=1.015	75	p<0.03
MERCURY-U	448%	0.80%	56	t=5.395	55	p<0.0005

U, urine; F, faeces

Apart from the 4 initial heavy metals tested, other metals such as Nickel (Ni), Bismuth (Bi), Uranium (U) and Mercury (Hg) were also tested in these trials, but only using pre- and post urine samples (not faeces).

All post sample measures were statistically significantly higher than the baseline measures for all metals, indicating that HMD™ was eliminating all the metals tested which included As, Pb, Cd, Sb, Ni, Bi, U and Hg. Table 2 also shows that the predominant route of excretion for all metals is via the urine, giving the added advantage of decreasing the possibility of re-absorption through the bowel.

Interestingly, when these individual components were tested separately, there was negligible chelating activity, but when they were combined together there was a powerful synergy that helped chelate and eliminate all the metals tested through the urinary route as opposed to the biliary route. This has added advantages as reabsorption of metals from the gut are prevented.

### Testing for mercury

Subsequent to the initial research, there was a separate trial for mercury alone that was conducted using 56 subjects. All urine

### Detailed results of the HMD™ compound trials

The only compound that was effective at mobilizing and eliminating all metals was HMD™, a proprietary synergistic blend of three natural ingredients in liquid form that are taken orally:

- Chlorella Growth Factor (CGF)
- Organic Coriandrum sativum leaf tincture
- Homaccord of cell-decimated, energised Chlorella pyrenoidosa

Table 2 shows the summarised results of a number of different trials over a three-year period. The mean percentage increase of heavy metals after provocation with the HMD™ is compared with the elimination with placebo (a highly diluted chlorella tincture). The post-provocation urine samples were collected after 24hours and the post-provocation faeces samples after 48hours due to the slower transit time—“U” denotes the Urine samples and “F” the Faeces samples.

**Table 2** Test results of the natural compound HMD™ - number of trials over a 3-year period

analyses were conducted on a mercury-dedicated

PSA Atomic Fluorescence Spectrometer measuring at levels of parts per billion. The 56 subjects participated in a 24-hour provocation trial using HMD™ at dosages of 40, 50 and 60 drops throughout the day. Initial six hour baseline pre-urine samples were collected, along with a 24-hour collection for the post-urine sample.

The results (Table 3) showed a 448 per cent increase in eliminated mercury in the post-test after 24hour provocation with HMD™ in the 56 people tested, compared to the baseline sample. Moreover, there was a negligible increase in mercury in the control group that was given only diluted powdered chlorella in a little alcohol. There was a statistically significant difference between the percentage increase of mercury in the post-sample compared to the controls ( $t=5.395$ ,  $df=55$ ,  $p<0.0005$ ).

### Liver and kidney serum test results during the HMD™ pre-post provocation trials

During the HMD™ research trials, blood samples were taken from a small group of people ( $N=16$ ) to determine the effects of the

HMD™ provocation on liver and kidney function tests. The average percentage increase was calculated from the pre-and post sample figures of these biochemical tests.

The main components tested were liver function (bilirubin, Alanine Aminotransferase (ALT), Aspartate Aminotransferase (AST), and kidney function (urea and creatinine).

Table 4 shows the percentage increase of these biochemical parameters in the post-serum samples, compared to the baseline serum sample before HMD™ was taken. Overall, there are small average increases in creatinine, bilirubin, urea, ALT and AST, but nothing that surpassed pathological parameters. The minimum and maximum levels are also shown, but generally the higher levels were present in one individual only.

It can be concluded from these tests that HMD™ is a “gentle chelator” that does not adversely affect liver and kidney function tests and is tolerable by most adults.

**Table 3** Results of the HMD™ testing in urine for mercury (N=56)

Provocation with HMD™	Mercury elimination in urine
Pre-test	12.62%
Post-test	448%

**Table 4** Details of the liver and kidney function tests

**Liver & kidney function test results during HMD™ provocation**

	Creatinine	Bilirubin	UREA	ALT	AST
% INCREASE	11.95	3.15	25.35	16.74	5.25
MINIMUM	0	0	0	0	0
MAXIMUM	42.8	20.19	53.73	75	38.46
N=	16	16	16	16	16

## Conclusion

This brief presentation of this three year research study to determine a cost-effective and safe metal chelator that can be used on a mass scale in metal foundries, as well as by the general population, has clearly shown that HMD™ has proven to be an effective natural chelator for As, Pb, Cd, Sb, Ni, Bi, U and Hg in all the trials conducted.

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None.

## Conflict of interest

Author declares there is no conflict of interest towards the manuscript.

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Dr Georgiou Georgiou, Ph.D., N.D has been an active clinician for over 35 years, and Founder/Director of the Da Vinci Holistic Health Center ([www.naturaltherapycenter.com](http://www.naturaltherapycenter.com)) which specializes in the treatment of chronic diseases. He is also the principal investigator of this HMD™ research as well as Director of the Da Vinci BioSciences Research Center, in Larnaca, Cyprus where he conducts laboratory and clinical research on heavy metals, novel ways of eradicating infectious diseases as well as Biophysics research. Email [admin@detoxmetals.com](mailto:admin@detoxmetals.com)

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