The Cal Apatite® Purity and Bioactivity Profile
The Key to Healthy Bone Mineralization and Positive Clinical Outcomes*

Skeletal Health for a Lifetime*
The Cal Apatite Purity and Bioactivity Profile is the culmination of an 8-year long, independent study initiated by Metagenics, Inc. Completed in 2007, this exclusive profile details the integrity and biological activity of our freeze-dried microcrystalline hydroxyapatite concentrate (MCHC), a whole bone extract and key ingredient in Metagenics’ Cal Apatite family of products. The profile describes the levels of naturally occurring constituents, which research suggests will support healthy bone mineralization.*

With this exclusive documentation, healthcare practitioners and their patients can be assured of the outstanding quality of Metagenics’ proprietary freeze-dried MCHC over other processing methods.

More than Calcium: Clinical Success is Improved by the Presence of Specific Bone Proteins*
More than three decades of research demonstrates that whole bone extracts, which contain approximately 25% protein, are more effective in supporting bone mineralization, as compared with ashed hydroxyapatite powder (devoid of intact protein), calcium carbonate, and other forms of calcium. When whole bone is subjected to temperatures exceeding 650° C (referred to as ashing) during processing, the protein constituent is almost or completely destroyed. Although ashed products may have a higher calcium content than whole bone extracts, research has shown that the whole bone extracts have greater efficacy.*

Various clinical trials demonstrating improved bone mineral density in menopausal women used whole bone extracts that contained measurable levels of total protein, collagen type 1 protein, osteocalcin, and delicate bone-derived growth factors – insulin growth factors 1 and 2 (IGF-1, IGF-2) and transforming growth factor beta (TGF-ß) and osteocalcin. In growth factor levels found in MCHC compared to other commercially available supplements. The preservation of the osteocalcin and the native bone-derived growth factors, particularly, IGF-1 and 2, and TGF-ß (shown in Table 1), serve as markers of exquisite raw material quality.¹

In the following investigation of growth factors in freeze-dried material, Metagenics sought to compare growth factor levels in products manufactured by an alternative vacuum drying method. Results of this testing are reported in Table 1. The levels found in the vacuum dried material, while approximately the same as reported by Stepan® and Fernandez‘, are significantly lower than the results obtained in the freeze-dried product. This supports the theory that the method of manufacturing can impact the retention of sensitive proteins such as growth factors, and that Metagenics’ freeze-dried MCHC produces a clearly superior product in terms of growth factor content.

<table>
<thead>
<tr>
<th>Growth Factors</th>
<th>OHC¹ µg/gram</th>
<th>OHC² µg/gram</th>
<th>Vacuum-Dried MCHC¹ µg/gram</th>
<th>Metagenics Freeze-Dried MCHC² µg/gram</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Bone-Derived Growth Factors</td>
<td>0.328</td>
<td>0.329</td>
<td>0.483</td>
<td>1.05</td>
</tr>
<tr>
<td>[Insulin Growth Factor-1 (IGF-1), Insulin Growth Factor-2 (IGF-2)] and Transforming Growth Factor-ß (TGF-ß)</td>
<td></td>
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<tr>
<td>Osteocalcin</td>
<td>7.015</td>
<td>6.99</td>
<td>604</td>
<td>595</td>
</tr>
</tbody>
</table>

The Purity Guarantee Predicts Safety
All natural ingredients absorb materials from the local environment in which they originate. In bone, heavy metals are a particular concern. To ensure safety, Cal Apatite MCHC is tested for heavy metal contaminants as well as microbial overgrowth. Furthermore, MCHC is produced from New Zealand free-range, pasture-fed cattle. The New Zealand government requires that each batch of product be accompanied by veterinary-signed certificates verifying the safety and disease-free status of the bovine source livestock.

References

* These statements have not been evaluated by the Food and Drug Administration. These products are not intended to diagnose, treat, cure, or prevent any disease.

Ingredient
MICROCRYSTALLINE HYDROXYAPATITE CONCENTRATE (MCHC)

Source
Selected bone from pasture-fed New Zealand Prime Cattle

Description
Free flowing creamy white powder

1000 mg of MCHC contains the following:

Mineral Complex
% Calcium (Ca): 250 – 271 mg/g (25 – 27%)
% Phosphorus (P): 114 to 124 mg/g (11.4 – 12.4%)
% Microcrystalline Hydroxyapatite: NMT 70% (max 700 mg/g)

Proteins
% Protein (N x 6.25): NLT 22
% Type 1 Collagen: 21 – 27%
% Glycosaminoglycan: 0.5-3 (as Chondroitin Sulfate)
Naturally Occurring Growth Factors 596 mcg – 761 mcg

Additional Naturally Occurring Trace Minerals
Boron 0.9 – 3.1 ppm
Manganese 0.40 – 0.55 ppm
Copper 0.1 – 0.3 ppm
Sulfur 740 – 870 ppm
Magnesium 3800 – 4000 ppm
Zinc 55 – 80 ppm

Naturally Occurring Heavy Metal Analysis
Lead: < 0.4 ppm
Mercury: < 0.05 ppm
Cadmium: < 0.1 ppm
Arsenic: < 0.2 ppm

X-ray Diffraction Analysis
Calcium and phosphorous confirmed present in crystalline hydroxyapatite form

Crystal Size
(86 – 95) Angstroms

Microbiological Analysis
Total Aerobic Count (TAC) (cfu per gram @ 35°C for 48 hours): NMT 1.0 x 10^4
Total Coliform Count (cfu per g): NMT 100
Clostridium perfringens (cfu per g): Not detected
Staphylococcus aureus (cfu per g): Not detected
Escherichia coli (mpn per g): Not detected
Salmonella (per 25 gram): Not detected
Yeast & Mold (cfu per g): NMT 100

ppm = parts per million = micrograms/gram (mcg/g) = milligrams/kilogram (mg/kg)

The raw material for this ingredient was collected to edible standards from New Zealand animals in USDA-approved New Zealand government export licensed establishments. The animals from which collection occurred have passed ante-and post-mortem inspection by a government inspector and were judged free of infectious and contagious diseases. BSE (Bovine Spongiform Encephalopathy) is not known to exist in New Zealand. The incidence of this disease has been under surveillance in countries since 1989. New Zealand is free of all O.I.E. list A diseases. New Zealand government veterinary-signed health certificates accompany each batch of product and verify the safety and disease-free status of the product.

† Typical analysis provided by supplier.