Omya

Calcium Carbonate

An efficient and highly bioavailable calcium source
Bioavailability of different calcium salts

There is little or no significant difference in the bioavailability of most of the calcium sources available

There have been many studies conducted and papers written about the relative bioavailability of calcium from milk and from the various calcium salts that are used in fortified foods and nutritional supplements.

Most studies found that there is little or no significant difference in the bioavailability of most of the calcium compounds available. A summary of those can be found on the next pages.

- For most applications there is no need to use an expensive calcium source
- Calcium carbonate should be the calcium salt of choice
- Calcium carbonate is very high in elemental calcium, thus low addition is needed to get the desired calcium content (see Table 1)
- Calcium carbonate is cost-efficient
- This combination makes it the most economical in use

No significant relationship between water solubility and bioavailability has been found. Calcium carbonate is insoluble in water, but soluble in the acidic environment of the stomach. Calcium carbonate reacts with the hydrochloric acid in the stomach, releasing Ca^{2+} ions which are absorbed in the small intestine. Studies have proven the fractional absorption of calcium coming from calcium carbonate to be on the same level as the calcium retention from dietary calcium.


2.) Weaver C.M.; International Dairy Journal, 8 (1998), 443-449
Overview of calcium content and solubility of different calcium salts

<table>
<thead>
<tr>
<th>Product</th>
<th>E-Number$^1$</th>
<th>Calcium Content$^2$</th>
<th>Solubility (in water, RT)$^3$</th>
<th>Functionality$^4$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium Carbonate</td>
<td>E 170</td>
<td>40 %</td>
<td>Insoluble</td>
<td>Fortification, acidity regulator, anti-caking agent, colorant</td>
</tr>
<tr>
<td>Calcium Sulphate</td>
<td>E 516</td>
<td>23 %</td>
<td>Insoluble</td>
<td>Acidity regulator, firming agent, fortification</td>
</tr>
<tr>
<td>Mono-Calcium Phosphate</td>
<td>E 341 i</td>
<td>18 %</td>
<td>Insoluble</td>
<td>Raising agent, acidity regulator, anti-caking agent</td>
</tr>
<tr>
<td>Di-Calcium Phosphate</td>
<td>E 341 ii</td>
<td>29 %</td>
<td>Insoluble</td>
<td>Acidity regulator, raising agent, firming agent</td>
</tr>
<tr>
<td>Tri-Calcium Phosphate</td>
<td>E 341 iii</td>
<td>39 %</td>
<td>Insoluble</td>
<td>Fortification, anti-caking agent, Stabilizer, firming agent</td>
</tr>
<tr>
<td>Calcium Hydroxide</td>
<td>E 526</td>
<td>54 %</td>
<td>Insoluble</td>
<td>Acidity regulator, firming agent, fortification</td>
</tr>
<tr>
<td>Tri-Calcium Citrate</td>
<td>E 333</td>
<td>21 %</td>
<td>Almost insoluble</td>
<td>Fortification, stabilizer, acidity regulator</td>
</tr>
<tr>
<td>Calcium Chloride</td>
<td>E 509</td>
<td>27 %</td>
<td>Soluble</td>
<td>Firming agent, stabilizer, thickener, fortification</td>
</tr>
<tr>
<td>Calcium Gluconate</td>
<td>E 578</td>
<td>9 %</td>
<td>Soluble</td>
<td>Fortification, acidity regulator, firming agent</td>
</tr>
<tr>
<td>Calcium Lactate</td>
<td>E 327</td>
<td>13 %</td>
<td>Soluble</td>
<td>Acidity regulator, firming agent, fortification</td>
</tr>
<tr>
<td>Calcium Lactate Gluconate</td>
<td>E 327 + E 578</td>
<td>12 %</td>
<td>Very soluble</td>
<td>Fortification</td>
</tr>
</tbody>
</table>

Table 1: Comparison of nutritional and technical properties of different calcium salts

2 According to chemical composition
3 According to manufacturer
4 Codex Alimentarius (http://www.codexalimentarius.net/gfsaonline)
Summaries of different bioavailability studies

Institute of Medicine of the U. S. National Academy of Science:

"Bioavailability of calcium when measured from nonfood sources, or supplements, depends on the presence or absence of a meal and the size of the dose. Supplement solubility is not very important, but tablet disintegration (for example, breaking apart) is essential."

"In studies that measured calcium absorption under similar test conditions, a 250mg elemental calcium load given with a standardized breakfast meal resulted in average fractional absorption rates of calcium from calcium citrate malate, calcium carbonate, and tricalcium phosphate of 35, 27, and 25 %, respectively. …Under the same conditions, absorption of calcium from milk was similar at 29 percent."

Bioavailability of Calcium in Breads Fortified with Different Calcium Sources:

"In breads fortified with five different calcium sources, calcium was equally well available from all sources, as judged based on calcium status of the femur in experimental animals and calcium absorption data. Calcium carbonate, a commonly used calcium source in fortified foods and in supplements, was one of the sources tested. This calcium salt can be viewed as good a source of bioavailable calcium as the more expensive sources."

Comparison of 3 Calcium Salts in College Women Using Isotopes:

"Average calcium fractional absorption form calcium lactate (35.2% ± 3.6), calcium carbonate (31.9% ± 5.9) and calcium sulfate (31.6% ± 5.4) was not significantly different in healthy college women."
Calcium Carbonate Compared to Calcium Lactates and Oyster Shells:

"We conclude that calcium is utilized to the same extent from calcium carbonate, DL-calcium lactate, L-calcium lactate and powdered oyster shell-calcium."

Solubility and Absorbability of Calcium Salts:

"When a variety of calcium salts (calcium carbonate, tricalcium phosphate, calcium citrate) with a range of 0.1-10mM in solubility in water at neutral pH were compared, no detectable difference in calcium absorption could be detected."

A Comparison of Several Calcium Supplements:

"The additional calcium sources used were milk, oyster shell, dolomite, calcium carbonate, ... calcium gluconate and calcium lactate ... Pronounced differences in apparent absorption of calcium supplements for the intestinal tract were not demonstrated."

Calcium Absorbability from Calcium Carbonate and Milk Products:

"Whole milk, chocolate milk, yogurt, imitation milk (prepared from dairy and nondairy products), cheese and calcium carbonate were...administered as a series of test meals...None of the sources was significantly superior or inferior to the others."
Omya production sites for food markets

Locations spread over the world to secure supply and to develop food business on a long term basis.

Omya is a leading global producer of industrial minerals, mainly fillers and pigments derived from calcium carbonate and dolomite, and a worldwide distributor of specialty chemicals.

The company’s major markets are forest products (fiber based products such as paper, board and tissue), polymers, building materials (paints, coatings, sealants, adhesives and construction) as well as life sciences (food, feed, pharmaceuticals, cosmetics, environment and agriculture).

Founded in 1884 in Switzerland, Omya now has a global presence extending to more than 150 locations in over 50 countries and 8,000 employees.
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