Maltobionic Acid, A Plant-Derived Bionic Acid for Topical Anti-Aging

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Maltobionic acid (4-O-α-D-glucopyranosyl-D-gluconic acid, MW: 358, pKa: 3.8) is a new polyhydroxy bionic acid formed by oxidation of maltose. Maltobionic acid is comprised of one molecule of D-glucose attached via an ether-type linkage to D-gluconic acid (a polyhydroxy acid or PHA).

![Maltobionic Acid Diagram](image)

A chemically similar compound to the well-known lactobionic acid, this novel ingredient has the advantage of being plant derived, as well as, gentle and non-irritating. Maltobionic acid is a strong humectant and is also an antioxidant/chelator.

Previous work has documented prominent anti-aging effects for lactobionic acid including skin plumping and smoothing of surface topography with diminished appearance of fine lines and wrinkles.¹

A study was conducted to evaluate the anti-aging effects of the new polyhydroxy bionic acid, maltobionic acid.

**Objective**

This poster will present safety data of maltobionic acid as well as clinical study results of a topical cream formulation containing 8% maltobionic acid to evaluate its anti-aging effects on human skin.
# Safety Profile of Maltobionic Acid

<table>
<thead>
<tr>
<th>Test</th>
<th>Test Material</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ames II Assay</td>
<td>10% maltobionic acid (aq.)</td>
<td>Non-mutagenic: no base pair or frame shift mutations in the presence of S9 fraction</td>
</tr>
<tr>
<td>2. Cell Viability: Epiderm (EPI-100)</td>
<td>8% maltobionic acid cream in contact with living skin equivalent for 1, 4, and 24 hours. Negative control: water; Positive control: Triton-X 100 (1%), a mild irritant</td>
<td>Test material was classified as innocuous and nonirritating</td>
</tr>
<tr>
<td>2a. PGE2 assay (EPI-100)</td>
<td>(above)</td>
<td>No inflammatory prostaglandin release; test material was equivalent to the water control</td>
</tr>
<tr>
<td>2b. Lactate Dehydrogenase (LDH) (EPI-100)</td>
<td>(above)</td>
<td>No increase in cellular lysis; test material was equivalent to the water control</td>
</tr>
<tr>
<td>2c. Interleukin-1α (EPI-100)</td>
<td>(above)</td>
<td>No effect on cytokines; test material was equivalent to the water control</td>
</tr>
</tbody>
</table>

### Anti-Aging Study Results

#### Study Conduct

- **Design:** prospective, direct-comparison to baseline scores (for visual grading & firmness) and to untreated control skin (for skin thickness & biopsies); protocol received IRB approval and informed consent was executed
- **Subjects:** 28 women, 35-58 years of age, Fitzpatrick types I, II and III (Caucasian), presence of mild-moderate periocular fine lines, periocular coarse wrinkles and mottled hyperpigmentation on the face
- **Product Application:** maltobionic acid, 8% cream, pH 3.8 was applied twice daily to the face and 3 times daily to one forearm; one forearm remained untreated as a control for forearm measurements
- **Clinical Evaluations:**
  - **Clinical Grading** (weeks 0, 6, 12): scores were collected visually by a trained evaluator using a 0 to 10 scale with 0.25 point increments for the following parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Site for Grading</th>
<th>Low Extreme of Scale</th>
<th>High Extreme of Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fine Lines</td>
<td>Eye area</td>
<td>0 = None</td>
<td>10 = Severe</td>
</tr>
<tr>
<td>Coarse Wrinkles</td>
<td>Eye area</td>
<td>0 = None</td>
<td>10 = Severe</td>
</tr>
<tr>
<td>-----------------------</td>
<td>----------</td>
<td>----------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>Pore Size</td>
<td>Cheek</td>
<td>0 = Invisible</td>
<td>10 = Very Large</td>
</tr>
<tr>
<td>Laxity</td>
<td>Cheek</td>
<td>0 = Firm, unpliable</td>
<td>10 = Loose, pliable</td>
</tr>
<tr>
<td>Roughness</td>
<td>Cheek</td>
<td>0 = Soft, smooth</td>
<td>10 = Rough, coarse</td>
</tr>
<tr>
<td>Sallowness</td>
<td>Face</td>
<td>0 = Light, non-yellow</td>
<td>10 = Dark, matte</td>
</tr>
<tr>
<td>Clarity</td>
<td>Face</td>
<td>0 = Dull, matte</td>
<td>10 = Clear, radiant</td>
</tr>
<tr>
<td>Mottled Pigmentation</td>
<td>Face</td>
<td>0 = Even tone</td>
<td>10 = Mottled, uneven tone</td>
</tr>
</tbody>
</table>

- **Pinch Recoil** (weeks 0, 6, 12) measurements were taken of the under eye area to assess skin elasticity by pinching the skin and recording time with a stopwatch (in hundredths of a second) to full recovery of the skin. The measurements were performed in triplicate, and the average score was reported. Pinch recoil is a recognized indicator of skin resiliency and firmness.

- **Total Skin Thickness (plumping) Measurements** (weeks 0, 12) were collected on the outer forearms using a hinged pinching device and digital calipers as previously described. Duplicate measurements representing a two-fold thickness of skin were taken and averaged at baseline and endpoint for both the treated and untreated control arms.

- **Irritation/Safety Grading** (weeks 0, 6, 12): global evaluation of objective irritation and safety was conducted for dryness, erythema and edema and subjective irritation scores were collected for burning, stinging, itching, tightness and tingling. Scale: 0 – 3 (none, mild, moderate, severe)

- **Digital Photography** (weeks 0, 12) was collected using standardized lighting and positioning

- **Self-Assessment** (weeks 0, 6, 12) was collected via questionnaires

- **3-millimeter Punch Biopsies** were collected at endpoint on the forearms of several study participants. Biopsies were stored in 10% formalin and subsequently processed for histological assessments

**Statistics**

- Clinical grading and pinch recoil: mean values were compared to baseline scores using a paired t-test, \( p \leq 0.05 \)

- Total skin thickness: mean values were compared to baseline scores using a paired t-test, \( p \leq 0.05 \). Comparisons between treated and untreated test sites were made using ANOVA with Fishers LSD for pair-wise comparisons

- Self-assessment questionnaires were tabulated and a top box analysis was performed
28 of 33 subjects completed the study. 4 subjects discontinued for reasons unrelated to the test product and 1 subject discontinued due to a reported allergic response.

Clinical grading revealed significant improvements in all of the visually graded parameters at 6 and 12 weeks compared to baseline, p<0.05.
Pinch Recoil/Firmness

Mean Relative % Improvement
(compared to baseline)

Firmness/elasticity was significantly improved at 6 and 12 weeks compared to baseline, p<0.05

Skin Thickness Measurements on Forearms

Mean Relative % Improvement
(compared to baseline)

* Significant increase in skin thickness (plumpness) compared to baseline, p<0.05.
† Significantly thicker than untreated (p=0.0001).
Facial Irritation Grading

Mean Scores

The test material was well tolerated with no increases in irritation parameters. *Denotes significant improvements in preexisting symptoms compared to baseline, p<0.05

Self-Assessment

Percentage of subjects responding "Excellent", "Very Good", or "Good"

Significant self-assessed skin improvements were noted. These findings support the clinical grading and efficacy measurements.
Histology Results

Epidermal Structure: 400X

Untreated control

Maltobionic acid 8%

Increased viable epidermal thickness and a more compact stratum corneum

GAGs: 400X

Untreated control

Maltobionic acid 8%

Increased density of dermal colloidal iron staining (blue color) representing glycosaminoglycans/acid mucopolysaccharides (GAGs)
Clinical Photographs

**Baseline**

Diminished periorcular fine lines and smoother texture at 12 weeks

**Baseline**

Improved texture, reduced pore size and erythema at 12 weeks
Maltobionic acid is a **new, plant-derived polyhydroxy bionic acid** for anti-aging and skin smoothing. Due to its polyhydroxy structure, it is a potent **humectant** and **antioxidant**. Safety studies indicate that this compound is **safe and nonirritating** to skin. The clinical study presented in this poster reveals **significant cutaneous anti-aging effects** of an 8% formulation. Benefits presented in this poster include:

- Increased skin thickness and plumping to provide skin smoothing effects
- Visual improvements in skin texture, clarity and roughness
- Increased skin firmness and elasticity
- Self-assessed improvements in skin texture, suppleness, degree of hydration and elasticity
- No irritation
- Histological effects

**References**

2. Date on file, NeoStrata Company, Inc.

Poster exhibit at the **64th Annual American Academy of Dermatology Meeting**; San Francisco, California; March 4-6, 2006.