Humulones

It’s getting hot in here
Hop Components

- Cellulose, etc.: 40.0%
- Water: 10.0%
- Polyphenol: 4.0%
- Resins: 15.0%
- Proteins: 15.0%
- Pectins: 2.0%
- Lipids: 3.0%
- Oils: 0.9%
- Ash: 8.0%
- Monosaccharides: 2.0%
- Amino Acids: 0.1%
Resins

- α-acids

<table>
<thead>
<tr>
<th>Name</th>
<th>Side Chain (R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humulone</td>
<td>-CO·CH₂·CH(CH₃)₂ isovaleryl</td>
</tr>
<tr>
<td>Cohumulone</td>
<td>-CO·CH(CH₃)₂ isobutyryl</td>
</tr>
<tr>
<td>Adhumulone</td>
<td>-CO·CH(CH₃)·CH₂·CH₃ 2-methylbutyryl</td>
</tr>
</tbody>
</table>
Resins

- β- acids

<table>
<thead>
<tr>
<th>Name</th>
<th>Side Chain (R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lupulone</td>
<td>$-\text{CO} \cdot \text{CH}_2 \cdot \text{CH}(\text{CH}_3)_2$ isovaleryl</td>
</tr>
<tr>
<td>Colupulone</td>
<td>$-\text{CO} \cdot \text{CH}(\text{CH}_3)_2$ isobutyryl</td>
</tr>
<tr>
<td>Adlupulone</td>
<td>$-\text{CO} \cdot \text{CH}(\text{CH}_3) \cdot \text{CH}_2 \cdot \text{CH}_3$ 2-methylbutyryl</td>
</tr>
</tbody>
</table>
The Boil

- Sterilization
- Protein Precipitation ("Hot Break")
- Bittering/isomerization of α-acids
  - Insoluble in wort & beer
  - Isomerization at 185 F
  - Enhanced bitterness and solubility of isomers
Isomerization

- What are isomers?
  - Re-arranged molecules
- Geometric Isomer
  - Double bonds, ring structures
- Cis/Trans Isomers

\[
\text{trans-1,2-dichloroethene} \quad \text{cis-1,2-dichloroethene}
\]
Isomerization

\[ \alpha\text{-acids} \xrightarrow{\text{isomerization}} \text{iso}\alpha\text{-acids} \]

- trans-isomers
- cis-isomers

- \( R = \text{CH}_2\text{CH(CH}_3)_2 \) humulone
- \( R = \text{CH(CH}_3)_2 \) cohumulone
- \( R = \text{CH(CH}_3)\text{CH}_2\text{CH}_3 \) adhumulone
- \( R = \text{CH(CH}_3)\text{CH}_2\text{CH}_3 \) isohumulone
- \( R = \text{CH(CH}_3)\text{CH}_2\text{CH}_3 \) isocohumulone
- \( R = \text{CH(CH}_3)\text{CH}_2\text{CH}_3 \) isoadhumulone

Isomerization of alpha acids.
Table 14. Relative bitterness of iso-α-acids

| Compound                  | Typical Proportion in Beer (%) | Bitterness Rank
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>trans-isocohumulone</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>cis-isocohumulone</td>
<td>30</td>
<td>2=</td>
</tr>
<tr>
<td>trans-isohumulone</td>
<td>10</td>
<td>2=</td>
</tr>
<tr>
<td>cis-isohumulone</td>
<td>40</td>
<td>4</td>
</tr>
<tr>
<td>trans-isoadhumulone</td>
<td>3</td>
<td>?</td>
</tr>
<tr>
<td>cis-isoadhumulone</td>
<td>10</td>
<td>?</td>
</tr>
</tbody>
</table>

\(^a\) 4 indicates most bitter. Equal signs indicate identical bitterness.
Perceived Bitterness

Fig. 84. Relationship between iso-α-acid isomer levels and perceived bitterness.
Bitterness Potency vs. Quality

- **Potency**
  - Measured Analytically
  - Spectrophotometer, HPLC, GC

- **Quality**
  - Measured by Sensory Methods
    - Effect of iso-humulone
      - Intense bitterness, low “linger”
    - Effect of iso-co-humulone
      - Mild bitterness, high “linger”
Co-Humulone Hop Tiers

- Low “Linger”, sharp bitter; (Snare Drum)
  - 15 – 24% Co-humulone
  - Amarillo, Citra, Simcoe, Nelson Sauvin

- Medium “Linger”, medium bitter; (Bass Drum)
  - 25% - 29% co-humulone
  - Apollo, Nugget, Summit, Warrior

- High “Linger”, soft bitter; (Gong Drum)
  - 30+ % co-humulone
  - Bravo, Cascade, Centennial, Chinook, Columbus
New Zealand Green Bullet

An all-purpose Southern Hemisphere variety with a proven track record in the brewhouse.

SKU: GRB

<table>
<thead>
<tr>
<th>Product tags</th>
<th>1.0 – 1.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total oils mls/100 gr.</td>
<td>1.0 – 1.4</td>
</tr>
<tr>
<td>Co-Humulone as % of alpha</td>
<td>41 – 43</td>
</tr>
<tr>
<td>Beta Acid Range %</td>
<td>6.5 – 7.0</td>
</tr>
<tr>
<td>Alpha Acid Range %</td>
<td>11.0 – 14.0</td>
</tr>
</tbody>
</table>

**Share on facebook** Share on twitter Share on tumblr Share on pinterest Share on favorites Share on print
References


- http://www.bsgcraftbrewing.com