peak organic brewing company

August 7, 2006

National Organic Standards Board
c/o Robert Pooler
Agricultural Marketing Specialist
USDA/AMS/TM/NOP
PO Box 96456
Washington, DC 20090-6456

Email: nlpetition@usda.gov

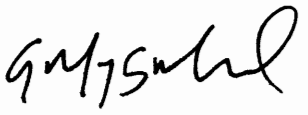
To the Review Board:

Enclosed is both the CBI and CBI-deleted copies of our petition for the inclusion of hops as a category of "Nonorganically produced agricultural products allowed as ingredients in products labeled organic."

We have also included a letter of support sent to us from Ralph Olson, owner of Hopunion.

Please contact us with any questions or additional information.

Best regards,



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Petition of Nonorganic Agricultural Substances to be Added to Section 205.606 of the National List.

Item A

Peak Organic Brewing Company is petitioning for the inclusion of **hops** as a category of "Nonorganically produced agricultural products allowed as ingredients in products labeled organic." The category of hops includes a huge number of varieties based on characteristics and region of growth, but specific forms that include whole hops, hop pellets, and hop extracts.

Item B

1. "Hops" are the common name for the scientific varieties of Humulus Lupulus.

2. **[CBI-deleted]**

3. Hops are a primary ingredient in the beer brewing process. Hops contribute flavor, bitterness, aroma, and clarifying agents to beer while acting as a natural preservative. While hops plants are grown in many different varieties by farmers all over the world, the only other products we are aware of which include hops are botanical dietary supplements and hop-derived teas.

4. The general category of hops contains a multitude of varieties from different regions of the world. Hops are grown in global regions which include Australia, Canada, Czech Republic, England, Germany, New Zealand, and the United States. The soil in which hops are grown must be loamy, well-drained, and fertilized with potash, phosphates, and nitrogen (1). Hops generally begin to grow in early April, growing vertically from an underground rootstock up a network of strings and wires set up by the farmer, reaching heights of 25 to 40 feet in just four months. The hop plants are harvested in September; severed at their bases and transported to picking sheds where the hop cones are mechanically stripped from their stocks and separated. They must immediately be dried to prevent hints of decomposition, and then pressed into bales and stored in refrigerators to maintain their freshness. Direct from the vine, a brewer can either use the whole hops, or hops in the form of pellets or extract.

- **Whole hops** are the natural hop cones that have been dried and baled. It can be argued that this form is the most inconsistent, bulky, poorest storage, and inefficient way to brew of all product forms. Still a number of the world's brewers use the whole hop claiming they prefer the all natural product (2).

    - **Hop pellets** are essentially whole hops that have been ground through a hammer mill and then pressed together through a pellet die. A comprehensive description of this form is available courtesy of Hopunion, our current supplier:

Hop Powder Pellets and Hop Pellets

There are four main types of product under this heading: - whole hop pellets, made from whole (unmilled) hops - hop powder pellets, made from milled hops and presented at different levels of enrichment. - stabilized hop powder pellets - isomerized hop powder pellets Whole hop pellets are prepared by freeing hops from foreign matter and then pelleting them without milling. In the past they were used by brewers with traditional hop backs who could not use powder pellets. They are not a significant product in modern beers but still see some use in Eastern Europe. Another form, the "half-ounce" plugs, were designed for use in dry hopping. These products reduced the volume of leaf hops and allowed for packaging in a vacuum but they did not greatly impact on utilization of hop materials in brewing. Hop powder pellets in various forms are used extensively in brewing around the world. Basic preparation consists of removing foreign material, milling in a hammer mill, blending batches of several hop bales together for product consistency, pelleting through a standardized pellet die, cooling and packing in aluminum based foil packs under vacuum (hard pack) or flushed with an inert gas (soft pack). Enrichment is achieved by milling at -35° C (to reduce stickiness of resin) and sieving to remove the coarser "waste" fraction. By metering a proportion of the "waste" fraction back into the line, standardization of the alpha acids level is assured. The major advantages of hop powder pellets relate to volume reduction, potential for greater storage stability, standardization and consistency and enhanced utilization. Compared to extracts they are, however, still bulky and possibly contaminated in one way or another. Users of pellets should also be aware of some potential differences in brewing behaviour between leaf hops and pellets. In leaf hops the resin glands are whole and it takes time for the boiling process to extract the oils and resins from the glands. In powder pellets the glands are ruptured and the contents smeared over the particles with a greater surface area exposed to the wort [unfermented beer]. This is the reason for the higher level of isomerization and utilization of the alpha acids experienced with powder pellets. The same phenomenon may, however, be less favourable for essential oil utilization. The relatively slow-release of oils from whole glands of leaf hops allows time for oxidation of the major hydrocarbons such as humulene to humulene epoxides, etc. thought to be responsible for good hop aroma in beer. The ruptured glands in powder pellets may lose the vast majority of these hydrocarbons by volatilization before the oxidation products have a chance to form. It is possible to overcome this loss by later additions of pellets but this is wasteful of the alpha acids. This phenomenon many not be significant in respect of the overall taste profile of many beers but it may help explain why some early powder pellet users had to adjust their hopping practices when moving to pellets or why other brewers even now do not choose to use the product despite its close relationship to leaf hops (3).

Modified Hop Powder Pellets

Other types of hop powder pellet products are the stabilized or modified pellets in which various additives have been used either to protect the alpha acids from oxidation or to enhance the efficiency of utilization. In one product up to 4% ascorbic acid is added to milled hops before pelleting. During the heat generating

process of pelleting and in subsequent storage the ascorbic acid is oxidized preferentially to the alpha acids. In a second instance activated bentonite clay is added prior to pelleting at a rate of 10 - 30%. This is thought to aid dissolution and isomerization in the wort. A notable disadvantage, of course, is the increased bulk of the product. The modified pellet which is most regularly used is the stabilized hop powder pellet in which about 2% magnesium oxide is added prior to pelleting. The heat produced in pelleting converts the alpha acids to their magnesium salts. These salts show a greater propensity to isomerize in wort boiling than the alpha acids themselves. Brewers have obtained increases in utilization of up to 10% (33 - 37% total utilization) using these pellets. This observation led to the most recent development in hop powder pellet evolution - the isomerized powder pellet. In this instance the pellet stabilized with magnesium oxide is heated to 50° C for 14 days after sealing under vacuum in the final package. The brewer, therefore, does not have to rely on wort boiling to isomerize the alpha acids. In this product it is thought that at least 90% of the alpha acids are isomerized. Problems in technical procedures do not currently allow a precise estimate of the degree of isomerization. Compared to unmodified hop powder pellets isomerized powder pellets show a large increase in utilization from 30 - 35% to 55 - 60%. Even though isomerization is apparently over 90% in the pellet there are still losses of iso-alpha acids in brewing beyond the wort boiling stage as there are in the use of leaf hops and other pellets. Another significant advantage is the reduced need for cold storage of this product. A notable disadvantage of this product perceived by some brewers is the heating of the hops and its effect on the essential oils. Without question the oil profile of the hop is altered but little data has been found which qualitatively defines these changes. The cooking volatilizes the low boiling point compounds which presumably cannot escape the package and will condense on cooling. During heating in the evacuated package the components will not oxidize but may well isomerize or otherwise degrade. As the isomerized pellets are usually added to the wort later in the boil than standard pellets the aromatic processes, either negative or positive, have less chance to occur than in the case of leaf hops or standard pellets. Considering all this, the safest statement is that the precise effects of isomerized pellets on hop aroma and flavor in beer are unknown. Brewers must explore this themselves with their own taste panels. The contribution of isomerized pellets to hop flavor and aroma is unlikely to be positive but may in fact be neutral or negative. In either case it may be possible to re-create the desired flavor profile by judicious use of aromatic leaf hops at various stages of boiling. The only other disadvantage of isomerized pellets is the perception of some brewers that they are a chemically processed product. In Germany, for example, the product could not be used as it falls outside the terms of the "Rheinheitsgebot" or German Beer Purity Law. This is true of all "chemically processed" hop products (3).

It is necessary to mention here that any product made with magnesium oxide as a processing aid could not be certified organic, regardless of the source of the hops, until MgO was added to the National List under section 205.605b. Therefore, these pellets won't be used in organic beer until

MgO is added to the list. Products made using ascorbic acid or bentonite clay could be certified, since both of these substances appear on the National List.

Hop Extract

- Many breweries around the world use a liquefied form of hops called hop extract. Peak Organic Brewing Company does not currently use hop extracts, however it is important to consider extracts with the category of hops. There are many types of this product. Advantages are consistency, less storage space required, minimal deterioration, and greater utilization. A disadvantage is that the hop has been changed in character (2). To make extract, the manufacturer basically removes the resins from the vegetative hop matter. To prepare the extract, hops are extracted using liquid CO2 at a temperature of 7 - 10° C and a pressure of 50 - 55 kg / cm2. CO2 is removed and the extract recovered at a temperature of 14 - 15° C. The alpha acids are isomerized and removed from the other hop material which becomes the base extract (4).

In the actual brewing process, hops are added to beer during the "boil", after the grains have steeped and the resulting sweetened liquid is boiled for sterilization, precipitation of proteins, and to reduce the grainy taste from the barley or wheat, depending on the style of the beer. Here, the hops are added just before cooling and fermentation. The bittering, flavoring, and aroma-enhancing characteristics of hops come from oils and resins in the hop flowers. Tiny capsules of resin found in hops are called lupulin. Hop resins are composed of two main acids: alpha and beta acids. Alpha acids have a mild antibiotic effect against bacteria, and flavor the activity of brewing yeast in the fermentation of beer. Beta acids do not isomerize during the boil of the wort, or unfermented beer, and have an insignificant effect on beer flavor. Instead, they contribute to a beer's aroma. The flavor imparted by hops varies by type and use: hops boiled with the beer produce bitterness, and are thus called "bittering hops". Hops added to the beer toward the end of the brewing process, usually during the last ten minutes, are called "flavoring hops", and some brewers add hops in the final three minutes of the boil for added aroma. "Dry hopping", or adding hops after the beer has been cooled and fermented, is a method for brewers to add maximum aroma, while not contributing to bitterness, which is determined by the degree to which the alpha acids are isomerized during the boil.

It is important to note that beer recipes contain a variety of these hops, based on unique characteristics, which impart specific flavors and cannot be interchanged with other varieties that may be commercially available as organic. In addition, if a recipe calls for "United Kingdom Target" bittering hops, and "New Zealand Hallertau" as aroma hops, one cannot simply interchange another hop variety and maintain the distinctive style, characteristic, taste, and consistency of the beer.

5. Hops are necessary for the production of Peak Organic Brewing Company's beer because while hops only compose approximately one percent of the overall ingredients,

beer simply cannot exist without hops. In addition to water, barley, and yeast, hops are one of the four essential ingredients to beer. There are no alternatives to hops.

The organic hops supply chain is a tenuous one characterized by uncertain supply and demand curves as well as governmental regulatory challenges and agricultural hurdles. Though it is a small supply chain involving few players, it has high levels of complexity that are currently being managed in a relatively unsophisticated fashion. As mentioned above, demand for organic hops is extremely uncertain because the primary commercial product that involves hops (beer) is not seeing large sales in the organic products space.

Supply, however, is also a driver of complexity in the chain. Because hop growing occurs in such a concentrated area in the United States (the Pacific Northwest states of Idaho, Washington and Oregon), it is difficult to attain adequate distance between organic hop crops from conventional hop crops. This means that the pests that prey on the conventional hops are ever present on the organic acreage, no matter how diligent and able the farmer is in their organic practice (5).

New Zealand, with a climate similar to the U.S. Pacific Northwest, has had more success in organic hop growing and is currently the leader in organic hop output. Because of New Zealand's isolation, the pests that plague hops worldwide, like the damson hop aphid and two-spotted spider mite, have not arrived on New Zealand soil, making the organic growing process much simpler there (6). Currently there are no commercial varieties resistant to these pests (7).

Organic hops are especially fragile and extremely difficult to grow consistently and supplies in the world are very limited and highly unstable. By nature hops are inconsistent in quality and freshness, and subject to contaminants throughout harvesting, packing, and shipping. During the course of a growing season, the crop is susceptible to infection by mildews and several fungal diseases such as the soil-born Verticillium. Organic hops coming from New Zealand travel a great distance, and can be contaminated if not packaged properly.

Peak Organic always sources organic hops first. Adhering to organic conduct, this process is documented for and overlooked by our Organic Certifier, Quality Assurance International (QAI). We contact multiple hop importers and distributors well before sourcing conventional hops if need be, as part of the agreed organic production system plan.

Aside from noticeable traits such as color, aroma, and appearance, the primary factor in assessing suitable hop quality is an alpha acid content analysis, submitted to our certifier, QAI. The organic hops Peak Organic Brewing Company has deemed unusable have contained drastically low amounts of alpha acids, to the point of which the beer's flavor would be insipid and unbalanced, and thus inappropriate to sell.

Furthermore, if a farmer announces that a certain organic hop is no longer available, a conventional form must be sourced to fulfill the recipe.

[CBI-deleted]

Peak Organic must use conventional, non-organic hops when organic hops are commercially unavailable, or available in sub-quality form. When Peak is unable to obtain organic hops in an appropriate form, quality or quantity to fulfill a recipe, conventional hops must be added to the National List so the company can continue to brew premium commercial organic beer.

(1) Charlie Papazian, "The New Complete Joy of Homebrewing", *Avon Books*, 1991.
(2) Hopunion LLC, http://www.hopunion.com/hop-intro.shtml 2003
(3) Hopunion, LLC, **http://www.hopunion.com/pellets.shtml**, 2003
(4) Hopunion, LLC, **http://www.hopunion.com/baseex.shtml** 2003
(5) Interview with Ralph Olsen, General Manager/Owner of Hop Union, April 22, 2005.
(6) Roger Protz, "The Organic Beer Guide", *Carlton Books*, 2002.
(7) National Hop Association of England, http://www.hops.co.uk/sectionthree/Growing.htm, 2006.

The following chart may be used by the NOSB as Evaluation Criteria for Substances to be Added to the National List Section 205.606.

Please include the following information:

Is the Substance Essential for Organic Production? Substance ___HOPS_____

Question	Yes	No	N/A	Documentation Source
1. Is the substance an agricultural product?	**X**			
2. Is the substance formulated or manufactured by a process that chemically changes a substance extracted from a nonorganic agricultural substance?			**X**	
3. Is the substance created by naturally occurring biological processes?	**X**			
4. Is there an organic source of the substance? [1]	X			QAI
5. Is the substance essential for handling of organically produced agricultural products? [2]	X			
6. Are there any commercially available alternative organic substances? [3]	X			QAI
7. Is there another practice that would make the substance unnecessary?		X		

[1] Documentation should specify details of efforts made to obtain an organic source and the outcome of that effort.
[2] Documentation should specify the essential qualities required for the product to be suitable, e.g., liquid vs. powder, viscosity, color, flavor profile, etc.
[3] Documentation should specify organic alternatives that have been evaluated and reasons for unacceptability.

HOPUNION

CBS, LLC.

P.O. Box 9697
Yakima, WA 98909
Phone: 1-800-952-4873 Fax: 1-800-952-4874

To Whom It May Concern:

This letter is to inform you that no hops are currently being grown organically in the US. Individuals have tried to accomplish growing hops using organic methods, but to date all have at some point had to revert back to traditional growing methods. We did have coupld of acres of Cascade hops that have been grown for the last few years, but understand they will not be grown this year. That was the only commercial field that I know was being grown in our industry.

As for imported hops, there are some organic hops being grown. The most popular place they come from is New Zealand. It gets lots of publicity, but the reality of the situation is that there is only one grower currently in New Zealand growing hops organically. As can be understood,this lends itself to very limited supplies expecially now that there is more demand. I do understand they want to expand in New Zealand, but this will take some time. The advanatage in that country is the lack of disease and pests that other hop growing countries have. There are some organic hops grown in England and Germany, but these are also very limited and many years are not available as the organic crop tends to fluctuate greatly from year to year in regards to quality and yeild.

In our industry, there is a trend to be more and more organic in the way we farm hops, but in reality hops are a difficult plant to grow 100%. Please feel free to call me with any questions or concerns at the 1800 number listed above.

Best Regards,

Ralph Olson
Hopunion CBS, L.L.C.

USDA/AMS/T&M/National Organic Program
Program Manager
Room 4008-S, Ag Stop 0268
1400 Independence Ave., SW
Washington, D.C. 202250

Dear Program Manager,

Please find our revised petition for Humulus Lupulus (Hops) to be added to the National List §205.606 for review by the National Organic Program NOP and the National Organic Standards Board (NOSB). As described in the NOP Draft Guidelines, each substance that is to be evaluated is to be petitioned separately.

In order to meet the requirements of the guidelines, we are including two copies of the petition for "Hops" with the four genetic variants we use exclusively in our products listed on said petition and a separate petition for each of the genetic variants of "Hops".

Each genetic variant is classed as Humulus Lupulus "Hops" but represent unique flavor and aroma characteristics due to variation in essential oils produced based on genetics.

Enclosed you will find:

- Petition for Humulus Lupulus (Hops) var. Hallertau Mittelfrüh (Elk Mountain farms), Saaz (Elk Mountain farms), and United States (Domestic) var. Willamette and Cascade Hops
- Petition for Humulus Lupulus (Hops) var. Hallertau Mittelfrüh (Elk Mountain farms)
- Petition for Humulus Lupulus (Hops) var. Saaz (Elk Mountain farms)
- Petition for Humulus Lupulus (Hops) var. United States (Domestic) var. Willamette
- Petition for Humulus Lupulus (Hops) var. United States (Domestic) var. Cascade
- Set of attachments as noted in the petitions

If you need any additional information, please do not hesitate to contact me and it will be provided immediately since time is of the essence. Thank you for your consideration.

Mr. Mark Sammartino
One Busch Place OSC-6
St. Louis MO, 63118
314-577-7005 ph
314-577-4574 fax

Petition to the National Organic Program and National Organic Standard Board for Humulus Lupulus (Hops) var. Hallertau Mittelfrüh (Elk Mountain farms), Saaz (Elk Mountain farms), and United States (Domestic) var. Willamette, and Cascade Hops to be added to the National List section 205.606

Item A

This is a petition to amend the National List Section 205.606 to include Humulus Lupulus (Hops) var. Hallertau Mittelfrüh (Elk Mountain farms), Saaz (Elk Mountain farms), and United States (Domestic) var. Willamette and Cascade Hops as a Nonorganically produced agricultural product allowed as an ingredient on or in processed products labeled as organic.

Item B

1. **Commom Name:**
   Hops

   Botanical/Latin Name:
   Humulus Lupulus

2. **Manufacturer's Name, Address and Telephone:**

- John I. Haas Inc. PO Box 1441, 31 N First Ave Yakima WA. 98907 (509)-469-4000
- Elk Mountain Farms HCR 60, Box 264 Westside Road Bonners Ferry, ID 83805 208-267-8569
- Hopunion CBS L.L.C. 203 Division St, Yakima, 98902 (509) 453-4792
- SS Steiner 1 W Washington Ave Yakima, Wa 98903-1543 (509) 453-4731

3. **The intended or current use of the substance:**

Humulus Lupulus (Hops) var. Hallertau Mittelfrüh (Elk Mountain farms), Saaz (Elk Mountain farms), and United States (Domestic) var. Willamette and Cascade, are used in our Organic Wild Hop Lager™ and Organic Stone Mill Pale Ale™. It is possible we may choose them for other organic products in the future.

Organic Wild Hop Lager™ and Organic Stone Mill Pale Ale™ are new products to the Anheuser-Busch portfolio and are being well received by our customers and the consumer. As demand and popularity of our Organic Beers grow, the likelihood of other New Products utilizing these varietals increases.

These varietals, Humulus Lupulus (Hops) var. Hallertau Mittelfrüh (Elk Mountain farms), Saaz (Elk Mountain farms), and United States (Domestic) var. Willamette and Cascade are used exclusively for their flavor and aroma characteristics. No other varietals have these unique flavor and aroma characteristics.

4. A list of the crop, livestock or handling activities for which the substance will be used. If used for handling (including processing), the substances mode of action must be described.

The described hops will be processed into type 90 hop pellets before use. This involves grinding the hops to a powder in a hammer mill, then extruding the hop powder through a 6 mm metal die to compact the powder into a pellet. There are no additives involved in the process and the product is 100% hops. A more full description of this process can be found at the websites below:

Hopsteiner - Committed to the brewer for six generations (attached)
YCI Products | YC-Hop Pellets (attached)
http://www.barthhaasgroup.com/cmsdk/content/bhg/products/pellets90.pdf (attached)

The only handling activity of the pelletized hops will be as an ingredient of specialty beer products.

Mode of action

Milled barley malt is steeped in hot water to enzymatically convert starches to fermentable sugars. The spent grain is then removed from the water solution (mash) and the mash is boiled to sterilize it. During this boil, hop cones or pellets are added to the brew kettle. During the boil, the most active bittering principle of the hops, the alpha acids are converted to iso-alpha acids. This thermally catalyzed reaction must occur in the brew kettle to dissolve these bittering compounds in the water mash. At the end of this boiling period, about an hour, the resulting solution is referred to as "wort". Hop cones or hop powder from hop pellets are then removed from the wort along with coagulated protein resulting

from the boil. The clear wort is then cooled and yeast added to convert the sugars in the wort to ethanol and carbon dioxide in the finished beer. Beer may be packaged in aluminum cans, glass or aluminum bottles or 15.5 or 7.75 gallon kegs for delivery to the marketplace.

Different hop varieties, such as Cascade, Hallertau mittelfrüh, Saaz or Willamette, each contribute their own characteristic type of bitterness and aroma to the finished beer.

5. The source of the substance and a detailed description of its manufacturing or processing procedures from the basic component(s) to the final product.

Commercial, dried hop cones are the fruit or inflorescence of the female hop plant (Humulus Lupulus). Hops are a perennial plant, and therefore, the portion of the plant above the ground dies off each winter, but the root or crown below the ground level shoots up a new set of bines (climbing vines) each spring. A trellis-work of poles is set in the hop yard to suspend a wire grid above the field. Each spring, a new set of strings or wires are strung from the wire-work to the hop plant below. The now bines which emerge each spring are hand trained onto to string or wire suspended from this trellis.

Over the coarse of the spring, the hop bine grows up the string or wire to the top of the trellis. Sometime around late June the plant blooms and begins to produce hop cones. These female flowers are called cones because the mature flowers resemble pine cones, but are soft, pliable and green. They are usually 1 to 2 inches long. These cones contain the flavoring compounds of interest to the brewer.

The hops mature or ripen anytime from early August to late September depending on the hop variety, local weather and cultural practices. During the harvest, the bines hop plants are cut about 3 feet from the ground level and the top portion of the hop plant is transported to a stationary hop picking machine. This machine mechanically removes and separates the hop cones from the rest of the plant.

At this point, the hop cones are about 80% water. They will spoil very quickly if not dried. The fresh cones are dried in a stream of hot air at 130 – 155° F for 4 to 8 hours to reduce the moisture content down to about 10%.

Then the hops are removed from the drier and allowed to cool on the floor in a pile for 12 – 24 hours. During this time, the hops not only cool down, but moisture is redistributed from the wet inner part of the cones to the over-dried outer portions of the cone. This gives the cone more mechanical strength when baled.

The hops are compressed into bales of various density and dimensions, depending on local custom and held together by food grade burlap or polyethylene cloth. The baled hops are then delivered to a cold storage warehouse within a day or two. Hops which are not stored cold will quickly lose their brewing value.

The following website contains more details on the commercial production of hops.

www.usahops.org/english/farm.asp (main information attached)

For use by the petitioner, the dried, baled hop cones will be processed into hop pellets before use in the brewery. Here, the baled, dried hops are ground to a powder in a hammer mill and the resulting powder is extruded through a metal die with a hole diameter of 3 – 7 mm, (6 mm is usually standard), resulting in hop pellets which are much more compact. The pellets are ¼ to 1 ½ inches long. These are packaged in 20 kg foil-lined polyethylene bags to keep out oxygen. The bags are packed into cardboard cartons for shipping and storage.

More details on the manufacture of hop pellets can be found at the websites below:

Hopsteiner - Committed to the brewer for six generations (attached)
YCI Products | YC-Hop Pellets (attached)
http://www.barthhaasgroup.com/cmsdk/content/bhg/products/pellets90.pdf (attached)

6. **A summary of any available previous reviews by State or private certification programs or other organizations of the petitioned substance,**

   To the best of our knowledge, no previous reviews have been conducted to approve the use of Humulus Lupulus (Hops), specifically Elk Mountain Farm Hops and other varietals grown in the United States (Domestic var.) as a nonorganically produced agricultural product allowed as an ingredient in or on processed products labeled as organic.

   Prior to the publication of the Federal Register, June 7, 2006, of the National Organic Program Final Rule addressing the court order following the case of Harvey vs. Johanns, there was no such clarification that each nonorganically produced agricultural product was required to be listed in §205.606 of the National List.

   The Summary of the NOP Final Rule of June 7, 2006 states:

   "Further, this final rule revises the NOP regulations to clarify that only nonorganically produced agricultural products listed in the NOP regulations may be used as ingredients in or on processed products

labeled as "organic." In accordance with the final judgment in Harvey, the revision emphasizes that only nonorganically produced agricultural ingredients listed in the NOP regulations can be used in accordance with any specified restrictions and when the product is not commercially available in organic form."

In addition, the NOP Final Rule revises National List § 205.606 to read:

"§205.606 Nonorganically produced agricultural products allowed as ingredients in or on processed products labeled as organic.

Only the following Nonorganically produced agricultural products may be used as ingredients in or on processed products labeled as "organic." Only in accordance with any restrictions specified in this section, and only when the product is not commercially available in organic form.
(a) Cornstarch (native)
(b) Gums—water extracted only)arabic, guar, locust bean, carob bean)
(c) Kelp—for use only as a thickener and dietary supplement
(d) Lecithin—unbleached
(e) Pectin (high-methoxy)"

This petition is in response to the revision of the National List §205.606 to approve , Humulus Lupulus (Hops) var. Hallertau Mittelfrüh (Elk Mountain farms), Saaz (Elk Mountain farms), and United States (Domestic) var. Willamette and Cascade as a nonorganically produced agricultural product allowed as an ingredient in or on processed products labeled as organic.

In consideration of the regulatory history and justification for the use of , Humulus Lupulus (Hops) var. Hallertau Mittelfrüh (Elk Mountain farms), Saaz (Elk Mountain farms), and United States (Domestic) var. Willamette and Cascade Hops, Quality Assurance International (QAI), nor California Crop Improvement Association conducted reviews of , Humulus Lupulus (Hops) var. Hallertau Mittelfrüh (Elk Mountain farms), Saaz (Elk Mountain farms), and United States (Domestic) var. Willamette and Cascade Hops.

QAI did approve the use of the conventional form by Anheuser-Busch Inc. of this product as an organic form was not proven to be commercially available organically.

7. <u>Information regarding EPA, FDA, and State regulatory authority registrations including registration numbers.</u>

This product conforms in every aspect to the requirements mandated by the Federal Food Drug and Cosmetic Act as well as State Regulations and Amendments.

This product is processed and packaged in accordance with good management practices as defined in 21CFR, §110, Subparts A-G. Text of this section can be found in the attachments.

No registration numbers are required for Humulus Lupulus (Hops) var. Hallertau Mittelfrüh (Elk Mountain farms), Saaz (Elk Mountain farms), and United States (Domestic) var. Willamette and Cascade Hops in either fresh or dried form.

8. **The Chemical Abstract Service (CAS) number or other product numbers of the substance and labels of the products that contains the petitioned substance.**

The product number for the petitioned substance, Humulus Lupulus (Hops) var. Hallertau Mittelfrüh (Elk Mountain farms), Saaz (Elk Mountain farms), and United States (Domestic) var. Willamette, and Cascade Hops are identified by a "Hop Lot Identification Number:"
Example:

Position:	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Lot #:	*2*	*3*	*2*	*D*	*S*	*A*	*6*	*1*	*0*	*5*	*0*	*0*	*9*	*L*

Position #1 – denotes crop year (Ex: 2 = 2002, 3 = 2003, etc…)
Position #2 – identifies country (2 = USA, 3 = Germany, 4 = France)
Position #3 – identifies growing region, for example:
If domestic, 1=Washington, 2=Oregon, 3=South ID, 4=North ID
If imported, 1 = Hallertau, 2 = Tettnang, 3 = Spalt
Position #4 – indicates whether the hops are (I) Imported or (D) Domestic

Position #5-7 – is the Variety Code, for example:
HAL = Hallertau variety
WIL = Willamette variety
GLA = Glacier variety
ALS = Alsace variety
CAS = Cascade variety
SA2 = Saaz 72, SA6 = Saaz 36, and SA8 = Saaz 38
Position #8-10 – denotes the Grower Code
Position #11-13 – denotes the Grower Lot Code
Position #14 – indicates the Package Size/Type as (L) Large, (S) Small, (P) Pellets

See attached labels of products that contain the petitioned substance.

9. <u>The substance's physical properties and chemical mode of action.</u>

<u>Hops</u>

Commercial hop cones are the dried inflorescence of the female hop plant. They are called "cones" because they resemble a pine cone, but are soft, pliable and green. Hop cones are typically ½ to 2 inches long, depending on variety and climate. The aroma of freshly picked or dried "aroma-type" hops vary from floral, to spicy to citrus, depending again on variety and origin. There should be no unpleasant off-odors in commercial aroma hops. Lower value "bitter-hops" on the other hand often have a pungent, aggressive or sour aroma notes to them, which results in inferior beer.

The Plant

Hop plants (Humulus Lupulus) are perennial climbing vines which typically grow 20 – 25 ft in a season. The climbing vines, which are called bines, are ¼ to ¾ inches in diameter. The leaves are about as long as they are wide, with a toothed margin. The leaves are 3 – 6 inches across. The leaves may be 7-lobed to 3-5 lobed, depending on the variety. The female cone is cylindrically symmetrical. The cone contains a central strig from which bracts and bracteoles originate. There is an ovary located at the base of each of the bracteoles of the cone.

The substances of interest to the brewer, alpha acids, beta acids and the essence oil of the hop, are found in the lupulin glands. These yellow to orange glands (depending on the variety) are inside the cone on the bracts and bracteoles, clustered near the strig. They are usually around 0.3 mm in diameter.

Agriculture and Farm Practices

The hop roots (or "crown") over-winter underground and each spring send out new bines. The bines grow on a trellis 14 – 24 feet tall. Emerging hop bines are cut back to the ground in April to help control mildew diseases. In May the second growth of bines is hand trained onto a wire or rope attached to the top of the trellis. The bines grow to the top of the trellis by late June and begin to flower. At this point, the hop bine stops growing, but side arms continue to grow to some extent. Now most of the energy of the plant is used to produce hop cones. Hop cones ripen anywhere from early August to late September depending on hop variety, weather, location and agricultural practices. At harvest, the entire hop bine is cut about 3 feet from the ground and brought to a stationary picking machine. The base of the bine is attached to a chain of the

machine which pulls the bine through machinery which removes the leaves and cones from the bine. The stream of cones and leaves is sent through a series of fans and treadle-belts to separate the leaves from the cones.

Freshly picked hop cones are about 80% water and will quickly spoil if not dried. Hop driers of various configurations are in use. All dry the hop cones for 4 – 8 hours with a stream of air heated to 130 – 155 deg F. The dried hop cones are removed from the drier and set aside in a pile for 12 – 24 hours to cool and redistribute moisture internally before being baled. The cones are then baled to various densities depending on local practice in burlap or polypropylene cloth. In most areas, these bales are quickly moved to cold storage to reduce the loss of brewing value of the hops. Typical yields for the highly prized aroma varieties range from 800 – 2000 lb per acre. Less prestigious bittering hops may yield 2000 – 3500 lb per acre.

For more details on farm practices see:

www.usahops.org/english/farm.asp (attached)

Hops are grown commercially in the Northern hemisphere between latitudes 44°N and 55°N. This is because the plant is very sensitive to the day length at the summer solstice. The plant needs 16 hours of daylight this time of year to properly regulate the bloom. If this does not occur, yields may be greatly impacted. Some varieties are more sensitive to this than others. The old European landrace varieties Hallertau and especially Saaz will not grow well below 48°N. This excludes their production in the traditional hop growing regions of the US; Oregon and the Yakima Valley of Washington. Genetically true selections of these hops are only grown commercially in North Idaho in the USA. Both of these hops are also not very heat tolerant. This excludes the Yakima Valley for quality and agronomic reasons for these hops.

Before being used by a brewer, cone hops are usually processed into more manageable form for the brewer. This is to ease handling and prolong the shelf-life of the hops. Most hops are processed into either hop pellets or an extract of the hops. Hop pellets are made by grinding the dried hop cones into a powder with a hammer-mill and then extruding the powder through a metal die with holes 4 – 7 mm in diameter. Six mm diameter pellets are fairly standard. The pellets are ¼ to 2 inches long. The pellets are then sealed in a foil lined polyethylene bag to protect them from oxygen. The pellets are much more uniform than the cones, take up half the space, still require cold storage, but keep much better than the raw hops. Nothing is added to the hops in the process. The pellets are 100% hops. Hop extracts are made usually from pellets. Hops may be extracted with food-grade liquid carbon dioxide or food-grade ethanol. The hops are packed into an extraction vessel and liquid carbon dioxide or ethanol is forced through the bed of hops. The solvent removes the components of interest to the

brewer. The solvent is then separated from the spent hops and the solvent is then evaporated away to yield a paste that is 100% hop derived substances.

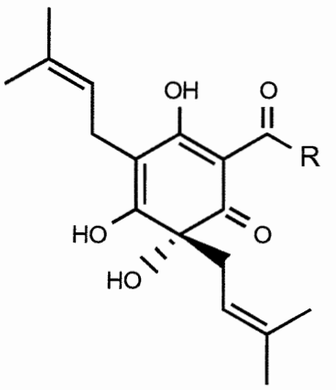
For more information on these products see:

www.barthhaasgroup.com/cmsdk/content/bhg/products/pellets90.pdf (attached)
www.barthhaasgroup.com/cmsdk/content/bhg/products/co2extract.pdf (atttached)
www.hopsteiner.com/regpellet.htm (attached)
www.hopsteiner.com/co2pg1.htm (attached)
www.hopsteiner.com/ethanol.html (attached)

It is our intent to use hop pellets.

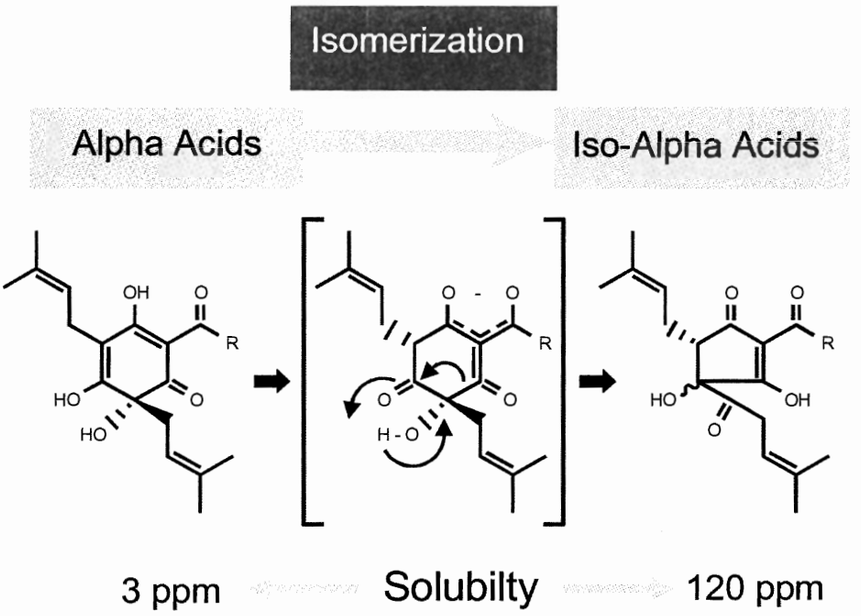
Use of Hops in the Brewery

Hops are added to the boiling mash in the brew kettle as beer is produced. The hops add not only bitterness to the beer to balance the sweetness of the grain, but also promote foam in beer, inhibit bacterial growth and add unique, non-bitter flavor or aroma to the beer. The quantity and make-up of the bittering resins and essence oil, the later being responsible for hop aroma in beer, vary greatly with the variety of hop. The principle bittering components of hops are called collectively, the alpha acids. They all have similar chemical structures as in the figure below. The alpha acids are converted to iso-alpha acids in the brew kettle. These are the bitter resins found in beer responsible for bitterness, foam stabilization and inhibition of bacterial growth.



Alpha Acid	R =	% of Alpha Acids
Humulone	iso-butyl $CH_2CH(CH_3)_2$	40-80%
Cohumulone	iso-propyl $CH(CH_3)_2$	17-50
Adhumulone	sec-butyl $CH(CH_3)CH_2CH_3$	5-15

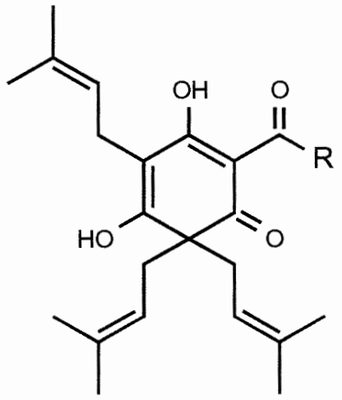
The different alpha acids in hops produce different iso-alpha acids in beer. These different iso-alpha acids have similar, but not identical bittering, foam stabilization and anti-bacterial properties. The amount and ratio of these various alpha acids is a function of hop variety. This changes the flavor profile from hop to hop.



Thermal Conversion of Alpha Acids to Iso-Alpha Acids

The world of commercial hops is divided between high value aroma hops, which are prized for their flavor characteristics and lower value "bitter" or "high alpha" hops, which are considered just a source of cheap alpha acids with lower quality flavor characteristics. Some hops have been introduced in recent years which are a hybrid of the two.

Classical aroma hops have levels of alpha acids from 2 – 6%, bitter hops, 10 - 16%. Classical aroma hops have about as much beta acids as alpha acids, bitter hops about 2 – 3 times as much alpha as beta acids. Beta acids (below) are structurally similar to the alpha acids, but cannot isomerizes when boiled because the hydroxyl group on the alpha acids involved in the isomerization reaction is replaced by a carbon chain, making the reaction impossible. Beta acids have a minor role in beer bittering and are not as important as the alpha acids. Classical aroma hops also have a different mix of alpha acids than do most bitter hops. As these different alpha acids have different brewing characteristics, this is one of the things that make the aroma hops more prized. Specifically, iso-co-humulone in beer, from the alpha acid co-humulone in hops (R = iso-propyl in the figure above) is believed to have a harsher, more lingering bitterness than iso-humulone (R = iso-butyl) and iso-ad-humulone (R = sec-butyl). In addition, iso-co-humulone is more unstable in beer, producing off-flavors more quickly than iso-humulone, which decomposes more quickly than does iso-ad-humulone in beer. There are also other alpha acids in minor concentrations in hops than also contribute to these flavors.



Beta Acid	R =	% of Beta Acids
Lupulone	iso-butyl $CH_2CH(CH_3)_2$	15-60%
Colupulone	iso-propyl $CH(CH_3)_2$	35-80
Adlupulone	sec-butyl $CH(CH_3)CH_2CH_3$	5-12

The charts below list hops considered as aroma hops and bitter hops with the overall alpha acids levels and percent co-humulone in the alpha acids mix.

Aroma Hop Varieties

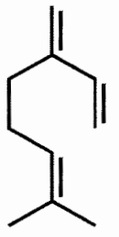
Variety	Growing Area	% Cohumulone in alpha acids fraction	% Alpha Acids
Saaz	Czech Republic, US	25-32	2-4
Tettnang	Germany/Tettnang	25-32	2-4.5
Lublin	Poland	25-32	2-4
Spalt	Germany/Spalt	25-32	2.4
Hallertau mf	Germany/Haller., US	19-27	3.5-5.5
Hersbrucker	Germany/Haller.	19-27	3-5
Strisselspalt	Alsace (France)	19-27	1-3
Fuggle	England	25-32	4.5-5.5
Willamette	US	31-35	4-6
Mt. Hood	US	22-24	4-6
Perle	Germany/Haller.	28-32	6-8.5
Spalt Select	Germany	22-24	4-6
Hallertau Tradition	Germany/Hallertau	28-32	4-6
Goldings	England	22-28	4.5-6
Saphir	Germany	12-17	2-4.5
Smaragd	Germany	13-18	4-6
Opal	Germany	13-17	5-8
Cascade	US	32-37	4.5-7

Bitter Hop Varieties

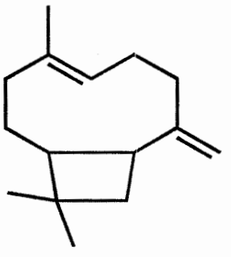
Variety	Growing Area	% Cohumulone In Alpha Acids Fraction	% Alpha Acids
Cluster	US	40-42	5-7
Galena	US	40-42	10-13
Nugget	US	26-30	11-14
Columbus	US	30	16
Northern Brewer	Germany/Haller.	26	6-10
Brewer's Gold	Germany/Haller.	45	5.5-8.5
Magnum	Germany/Haller.	22-26	14-16
Taurus	Germany/Haller.	22-26	14-16
Herkules	Germany	32-38	13-16
Target	England	35	10-13
Chinook	US	30	11-13
Pride of Ringwood	Australia	33	9-11

In recent years, some high alpha hops with relatively low cohumulone have been developed. These have more acceptable bittering characteristics than most of the other high alpha hops, but their aroma characteristics are still inferior to the classical aroma hops. The aroma comes from the essence oil of the hop. The chemical make-up of the essence oil varies wildly from variety to variety. The total amount of the oil correlates well with total alpha acids, with aroma hops typically with a bit less than 1% essence oil in the dried cones, and bitter hops with 2 – 3%. So it is not the quantity of essence oil that matters, but the chemical make-up of that oil. Hop oil of all varieties is a complicated mix of terpene hydrocarbons such as myrcene (below) and sesquiterpene hydrocarbons such as caryophyllene and humulene.

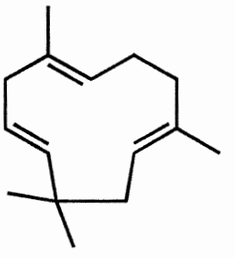
Hop Essence Oil Components



MYRCENE



CARYOPHYLLENE



HUMULENE

Hop essence oil contains hundreds of individual compounds which have been identified. The chemical make-up of the essence oil is so unique to individual hop varieties, that most varieties can be identified uniquely by analysis of the essence oil. In addition to these terpene and sesquiterpene hydrocarbons and their corresponding alcohols and oxidation products, there are many aliphatic alcohols, carbonyl, esters and acids in hop oil. The mix of these is also strongly related to hop variety. In general, the aroma varieties are richer in sesquiterpene derived compounds than the bittering hops, which contain more terpene derived compounds. The make-up of the essence oil is what gives each hop it's unique aroma profile in beer.

Making beer with aroma hops vs. bitter hops is much like wine made with specific varietal grapes vs. table grapes. Using fine, high value hops or grapes results in a much more flavorful and pleasing beverage than the use of cheaper inferior quality bitter hops or table grapes. Just as wine connoisseurs are very particular about a variety of grape, beer connoisseurs respond to hop varieties used in beer. This perception is not as wide spread in the beer industry as with wine, but is especially important in the craft brewing industry where the major demand for organic beer exists.

Nutritional Highlights

The chemical make-up of a typical commercial dried aroma hops is presented below. As about 100 times more grain is used to make beer as hops by weight, the dose of carbohydrate and protein from the hops is minimal. The hop resins (alpha and beta acids) the essence oil and the tannins or polyphenols are the important fractions. These contribute to overall beer quality and nutrition. There are no known nutritional disadvantages to ingestion of hops in the quantities found in commercial beers, outside of allergies. In fact, there are possibly considerable medical advantages to the ingestion of hops. This will be discussed in another section.

Constituent	Percentage
Water	6 – 12%
Soft Resins	
Alpha acids	2 – 6%
Beta acids	4 – 6%
Essence oil	0.5 – 1.0%
Hard Resins	
Polyphenols (Tannins)	3 – 5%
Amino Acids	0.1%
Simple sugars	2%
Pectin	2%
Other digestible carbohydrate	5%
Oils and Fatty acids	0 – 2%
Protein	15%
Ash (Mineral Content)	8 – 10%
Cellulose	40 – 50%

a) Chemical interactions with other substances, especially substances used in organic production.

There are no known chemical reactions with other substances used in production of finished, dried hops. In production of beer, the iso-alpha acids derived from the alpha acids in the hops do weakly bind with proteins in the beer to promote foam. This interaction is weak and reversible in the human digestive tract. It is of no risk to the consumer.

b) Toxicity and environmental persistence

Hops compost in nature just like any other plant derived, cellulose-rich material. There is nothing unique to hops that is known to be toxic.

Various plant protection preparations are used in the production of commercial hops, but all of these are approved by EPA and state regulatory authorities before use.

There is no evidence of toxicity or environmental persistence from the production of hops when done according to EPA guidelines.

c) Environmental impacts from its use or manufacture

There are no known environmental impacts from the production, drying or pelletizing of hops.

d) Effects on human health

There is no evidence of any effect on human health from the production of dried hop cones, hop pellets or hop extracts. Some individuals may suffer from allergic reactions to hops, resulting in red eyes, a runny nose or sneezing, these are no more serious than hay fever.

Some flavonoid compounds derived from hops have been shown to have certain health beneficial effects in cell culture (in Vitro) studies. Some examples can be viewed in the websites below. Whether there is enough of these compounds in beer or hops to effect these results, or if these results have any relevance to ingested hops or beer (in Vivo) is questionable.

www.oregonstate.edu/dept/ncs/newsarch/2005/Oct05/beerandcancer.htm
www.flavonet.org/dkfz/index.html
www.zhion.com/herb/Hops.html
Mechanisms of the antiangiogenic activity by the hop flavonoid xanthohumol: NF-κB and Akt as targets -- Albini et al., 10.1096/fj.05-5128fje -- The FASEB Journal
Cancer Chemopreventive Activity of Xanthohumol, a Natural Product Derived from Hop -- Gerhauser et al. 1 (11): 959 -- Molecular Cancer Therapeutics
The Chalcone Xanthohumol Inhibits Triglyceride and Apolipoprotein B Secretion in HepG2 Cells -- Casaschi et al. 134 (6): 1340 -- Journal of Nutrition
Antioxidant Activities of Flavonoids

Certain hop flavonoids found in beer have shown strong anti-cancer, and anti-diabetes properties with cell culture studies. These compounds have also demonstrated the ability to slow loss of calcium from human bone in cell culture studies. Whether this has any relevance to living organisms is not known. No toxic effects were found in these cell culture tests.

e) Effects on soil organisms, crops and livestock

There are no known adverse effects from hops or hop cultivation on soil quality, organisms, adjacent crops or livestock health.

10. Safety information about the substance including a Material Safety Data Sheet (MSDS) and a substance report from the National Institute of Environmental Health Studies.

Below are web links to MSDS sheets for commercial hop pellets:

http://www.yakimachief.com/hopproducts/YC-Type90-Hop-Pellets_MSDS.pdf (attached)
http://www.barthhaasgroup.com/cmsdk/content/bhg/products/msds_pellets90.pdf (attached)

No substance report on hops or hop pellets could be found at EPA or NIEHS websites.

11. Research information about the substance, which includes comprehensive substance research reviews and research bibliographies, including reviews and bibliographies, which present contrasting positions to those presented by the petitioner in supporting the substances inclusion on or removal from the National List.

Research Information

Included in the Web Links below are brewing industry proffessionals explaining the importance of hop variety to the flavor profile of beer and how a specific hop is needed for a specific beer flavor profile.

Also Listed in the attachments are Hop aroma and Flavor and Flavors of Beer by Hop Variety.

Hop Aroma and Flavor (attached)
Hopunion CBS LLC. - Hop Variety Characteristics Booklet (home page attached)
Flavour of beers by hop variety (attached)

There is no evidence of research that would present contrasting positions to those presented in this petition.

12. Petition Justification Statement

Anheuser-Busch Companies, Inc. Organic Beer Organic Wild Hop Lager™ and Organic Stone Mill Pale Ale™ were formulated with very specific flavor and aroma profiles. The ingredients, Humulus Lupulus (Hops) var. Hallertau Mittelfrüh (Elk Mountain farms), Saaz (Elk Mountain farms), and United States (Domestic) var. Willamette, and Cascade Hops, are a vital part of the flavor and aroma profiles. These products would have a distinctly different flavor and aroma profile without this (these) ingredient(s).

Our sales would be negatively impacted if the Humulus Lupulus (Hops) var. Hallertau Mittelfrüh (Elk Mountain farms), Saaz (Elk Mountain farms), and United States (Domestic) var. Willamette, and Cascade Hops were removed (or compromised) in our formula.

Stone Mill Pale Ale:
Elk Mountain Farms Humulus Lupulus (Hops) var. Hallertau Mittelfrüh
United States Humulus Lupulus (Hops) Domestic var. Cascade

Stone Mill Pale Ale received the 2006 People's Choice Award for the Best beer at the Hunter Mountain Microbrew and Wine Festival. (Document attached)

Wild Hop Lager:
Humulus Lupulus (Hops) var. Saaz (Elk Mountain farms)
United States Humulus Lupulus (Hops) Domestic var.Willamette, and Cascade

Wild Hop Lager received a Bronze Medal at the 2006 World Beer Championships. (Document attached)

Our organic products were introduced to the market in September of 2006 nationally, and we anticipate increased sales in subsequent years.

The ingredients, Humulus Lupulus (Hops) var. Hallertau Mittelfrüh (Elk Mountain farms), Saaz (Elk Mountain farms), and United States (Domestic) var. Willamette, and Cascade Hops, are a vital part of the flavor and aroma profiles. Our products contain greater than 95% organic

ingredients and we use organic ingredients for the remaining percentage when they are available.

After diligent industry exploration, we have determined that Humulus Lupulus var. Hallertau Mittelfruh (Elk Mountain Farms), Saaz (Elk Mountain Farms) and United States var. Willamette, and Cascade Hops are not available in organic form in the minimum quantity necessary for our production requirements.

Petition to the National Organic Program and National Organic Standard Board for Humulus Lupulus (Hops) var. Hallertau Mittelfrüh (Elk Mountain farms), Saaz (Elk Mountain farms), and United States (Domestic) var. Willamette, and Cascade Hops to be added to the National List section 205.606

List of Attachments

- **Product Labels**
  Anheuser-Busch Companies, Inc. dba Green Valley Brewing Co.
  Wild Hop Lager
  Stone Mill Pale Ale

- **Letters from Hop suppliers** noting the unavailability of organic Hops in the quantities and of the quality we require.

- **Hop Lot Identification Number** Designation Sheme

- **MSDS Sheets**

- **Organic Introduction** (internal marketing)

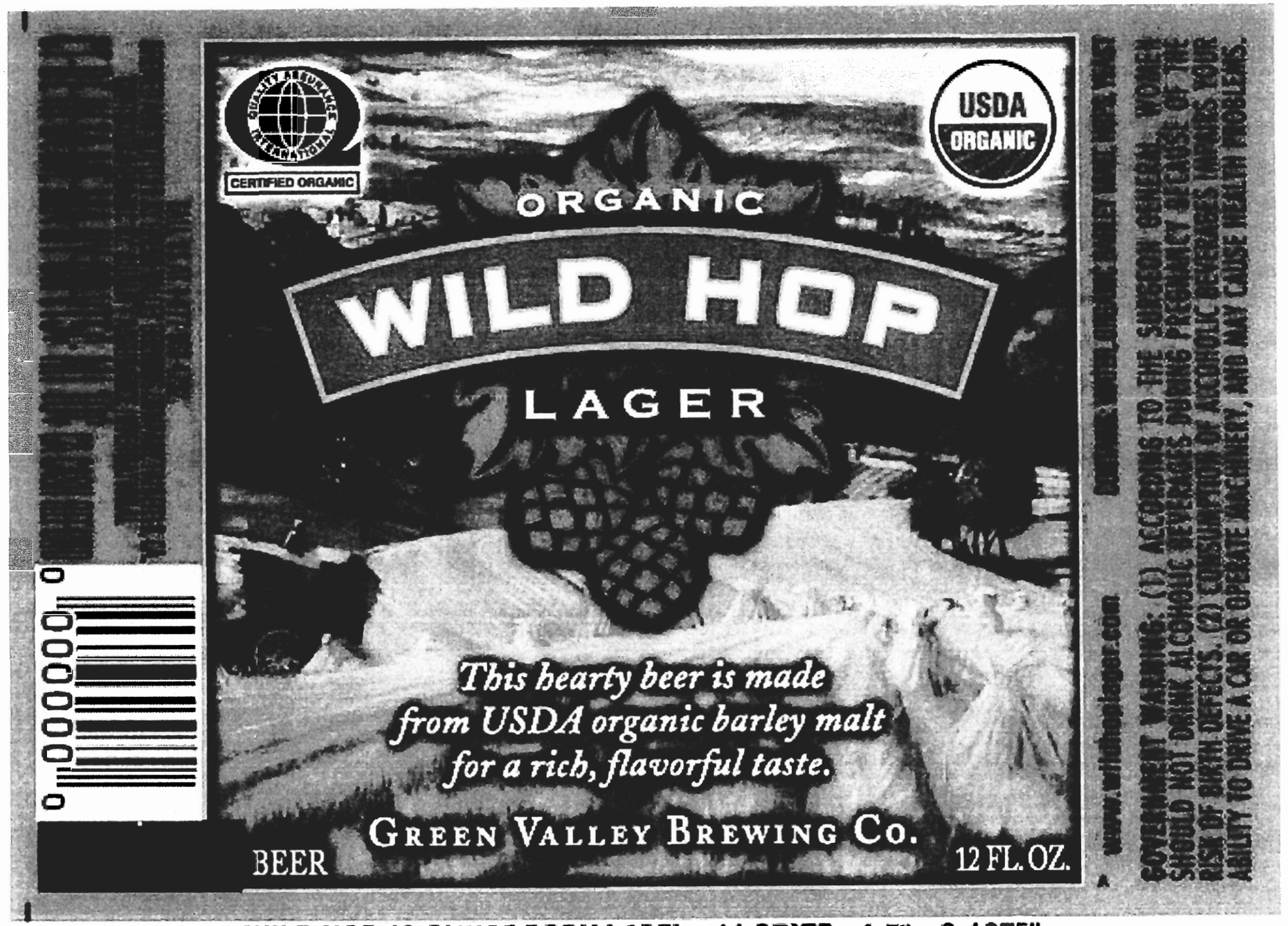
- **Awards** Documents

- 2000 James Beard Foundation Journalism Award Winner
  "Experiments with Hops, A Welcome Development"

- The Essential Oil of Hops;
  Aroma and Flavor in Hops and Beer

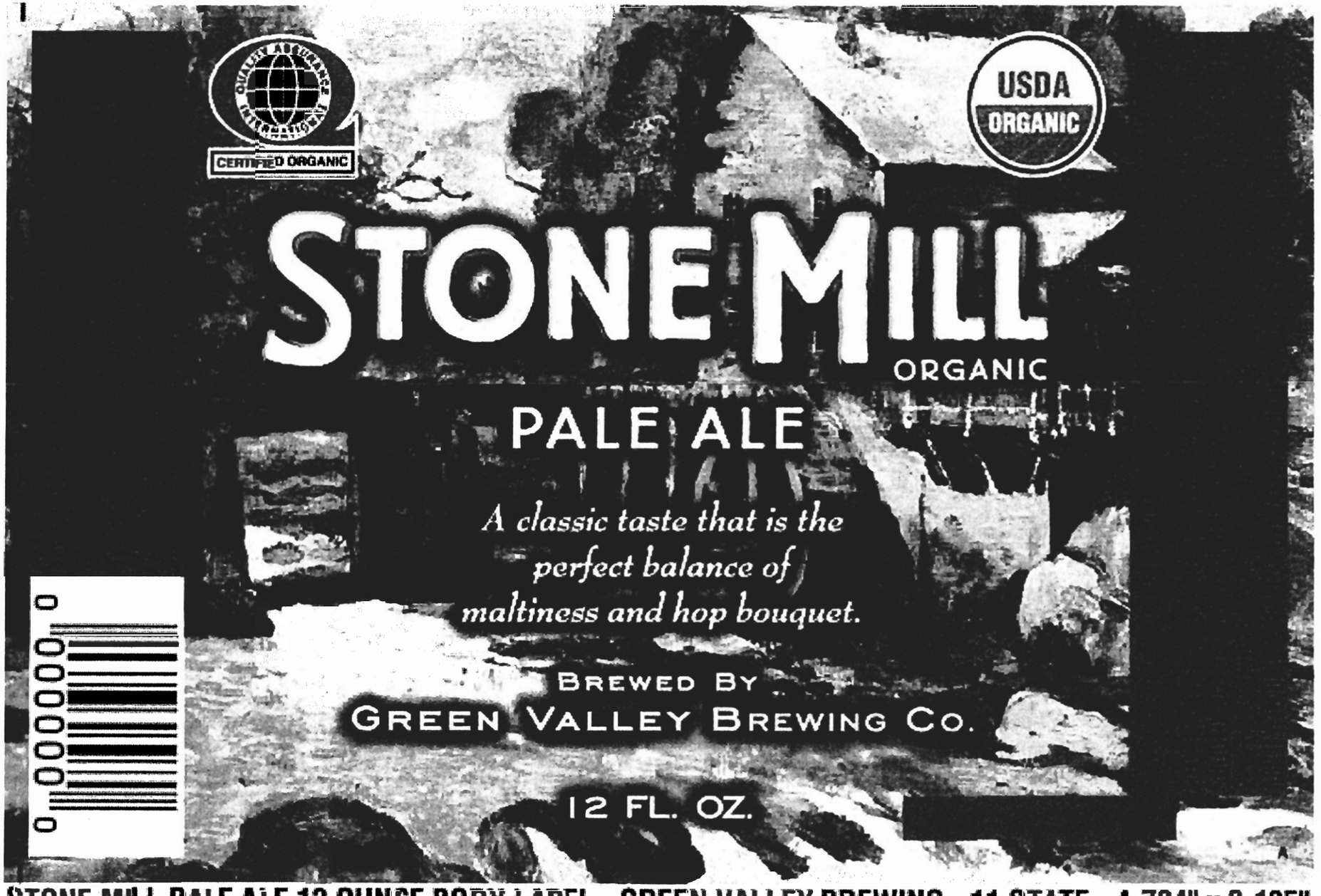
- **Flavour of Beers by Hop Variety**

- **Various Website Printouts as noted within the contents**



WILD HOP 12 OUNCE BODY LABEL - 11 STATE - 4.5" x 3.1875"

WILD HOP 12 OUNCE NECK LABEL - 11 STATE - 2.1875" x .875"



STONE MILL PALE ALE 12 OUNCE BODY LABEL - GREEN VALLEY BREWING - 11 STATE - 4.724" x 3.125"

STONE MILL PALE ALE - NAC - 4.756" x .906"

HOPUNION
CBS, LLC.
203 Division Street
Yakima, WA 98902
Phone: 1-800-952-4873 or 509-453-4792
Fax: 1-800-952-4874 or 509-453-1551
www.hopunion.com
hops@hopunion.com

CERTIFICATE

Mr. Tom Crown
Anheuser-Busch, Inc.
PO Box 500736
St. Louis., MO 63150-0736

June 1, 2006

Dear Tom:

As per your recent request regarding the availability of organic hops sold by Hopunion CBS, LLC please note the following. We certify that the following hops are not commercially available for sale from Hopunion at this time:

Organic Willamette
Organic Saaz
Organic Cascade
Organic Hallertau

We trust this will help you with your organic brewing certification process. Please feel free to call us at 1-800-952-4873.

Sincerely,

Ralph Olson
Owner/GM
Hopunion CBS, LLC.
Yakima, WA

HAAS®
DEALER HOPS GROWER
PROCESSOR

JOHN I. HAAS, INC.

SUITE 300
5185 MACARTHUR BOULEVARD, N.W.
WASHINGTON, D.C. 20016-3341
TELEPHONE: (202) 777-4800
TELEFAX: (202) 777-4895

May 25, 2006

To Anheuser-Busch, Inc.

Our company is the largest hop marketer in the US and operates several hop farms and processing plants in the Pacific Northwest. We have a wide ranging customer base, from small brewers to the world's largest beer makers, both domestically and internationally. These diverse customers demand a multitude of varieties and products. The varieties Cascade, Willamette, Saaz and Hallertau are part of our variety portfolio, all of which are produced and / or sourced in the Pacific Northwest hop production areas. While these varieties grow well under standard production systems, attempts to cultivate these hops in commercial quantities on an organic basis have all failed. As such, John I. Haas, Inc. can neither offer nor grow any commercial quantities of the varieties Cascade, Willamette, Saaz and Hallertau on an organic basis.

Respectfully,

Alexander Barth
EVP

S. S. Steiner, Inc.

Hopsteiner
SINCE 1845

655 MADISON AVENUE, NEW YORK, NEW YORK 10021-8078 • TELEPHONE: 212-838-8900
CABLE ADDRESS: "HOPSTEINER" NEW YORK • TELEFAX: 212-593-4238
CALDWELL, IDAHO • SALEM, OREGON • YAKIMA, WASHINGTON

June 1, 2006

Mr. Thomas S. Crown, Senior Manager
Brewing Commodity Purchasing-Domestic
Anheuser-Busch Companies.
One Busch Place
St. Louis, Mo. 63118

RE: ORGANIC HOPS

Dear Tom:

Referring to your inquiry, we regret to advise that we are unable to supply commercial quantities of organic U.S. Hallertau, Cascade, Willamette or Saaz hops.

Please advise if you have any other questions

Sincerely yours,

S. S. STEINER, INC.

Martin Ungewitter
Senior Vice President

MU/rf

Flavor You Can Feel Good About.

Why Go Organic

The organic/natural food market is growing and is currently three percent of the overall industry ($17 billion). Environmentally conscious consumers are looking for certified organic products including beer, the fastest growing organic beverage.[1] Capitalize on this growing market with Wild Hop Lager and Stone Mill Pale Ale, the first nationally distributed organic beers in the lager and pale ale categories!

STONE MILL ORGANIC PALE ALE

ORGANIC WILD HOP LAGER

- STRs Sept. 18, 2006
- Capitalize on the opportunity to reach new retailers and consumers
- Both carry the USDA Organic and the QAI Certified Organic seal
- Secondary packaging is printed on 100% recycled materials
- Growth for organic foods is expected to continue in the 10-12% range[1]
- Organic/natural foods are a growing market in the US Food Industry at 3% of overall industry ($17 billion)[2]
- 2% of grocery store sales are organic products[2]
- USDA *Certified Organic; not many* beers that claim to be organic are "certified"
- The USDA Organic seal can only be used if 95% or more organic ingredients are used

Source:
[1] Organic Trade Association
[2] Health Strategy Consulting Analysis

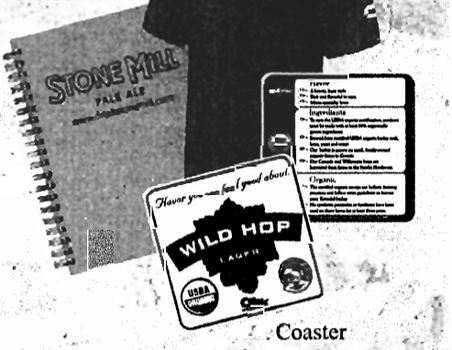
Signmaking

Shelf Wobbler

Polo Shirt

Shelf Wobbler

Notebook



Coaster

Signmaking

2006
World Beer Championships
Category Results

910 W. Van Buren St. Suite 5000 Chicago, IL 60607 USA Phone: 312-226-7857 Fax: 312-226-7858

179319	84 • Niagara Brewing Company (Canada) Millstone Lager. Bronze Medal	5.00
179346	84 • Moosehead Breweries (Canada) Alpine Lager. Bronze Medal	5.00
179457	84 • Anheuser Busch (MO) Wild Hop Organic Lager. Bronze Medal	5.00
179482	84 • Ursus Breweries (Romania) Timisoreana. Bronze Medal	5.00
179334	83 • Rogue Ales (OR) Kell's Irish Lager. Bronze Medal	

Pilsner, Lager — 25

179331	93 • Krusovice (Czech Republic) Imperial Lager. Gold Medal	5.50
179379	91 • Haywards (India) 5000 Indian Lager. Gold Medal	7.00
179251	90 • Privat Brauere Bischoff (Germany) Premium Pilsner. Gold Medal	4.70
179496	90 • Capital Brewery (WI) Special Pilsner. Gold Medal	11.83
179775	90 • Braueri Hirt (Austria) Hirter Privat Pils. Gold Medal	5.00
179275	89 • Paulaner Brauerei (Germany) Premium Pils. Silver Medal	4.90
179337	88 • Brauerei Pinkus Muller (Germany) Ur Pils. Silver Medal	5.20
179481	88 • Ursus Breweries (Romania) Premium Lager. Silver Medal	5.00
179483	88 • Bethlehem Brew Works (PA) Chain Link Pilsner. Silver Medal	4.70
179522	88 • Trumer Brauerei (CA) Trumer Pils. Silver Medal	4.90
179332	87 • Radeberger (Germany) Pilsner. Silver Medal	
179629	87 • Labatt Blue (Canada) Canadian Pilsner. Silver Medal	5.00
179631	87 • Brauerei Beck & Co. (Germany) Beck's Pilsner. Silver Medal	5.00
179335	86 • Rogue Ales (OR) Uberfest Pilsner. Silver Medal	
179344	86 • North Coast Brewing Co. (CA) Scrimshaw Pilsner. Silver Medal	4.20
179491	86 • Cross Plains Brewery (WI) Special Pilsner. Silver Medal	4.90
179585	86 • Industrias La Constancia S.A de C.V (El Salvador) Pilsener Centenario. Silver Medal	4.60
179328	84 • Lakefront Brewery (WI) Klisch Pilsnner. Bronze Medal	5.50
179484	84 • Kingfisher Brewing Company (NY) Premium Lager. Bronze Medal	5.00
179586	84 • Industrias La Constancia S.A de C.V (El Salvador) Golden Light. Bronze Medal	4.10
179589	84 • Industrias La Constancia S.A de C.V (El Salvador) Suprema. Bronze Medal	5.30
179485	83 • Hansa (South Africa) Pilsener. Bronze Medal	4.50
179529	83 • Carling (South Africa) Black Label Lager. Bronze Medal	5.50
179588	83 • Industrias La Constancia S.A de C.V (El Salvador) Regia. Bronze Medal	5.30
179587	81 • Industrias La Constancia S.A de C.V (El Salvador) Bahia. Bronze Medal	4.60

Reduced Calorie Lager, Lager — 6

179229	90 • The Boston Beer Co. (MA) Samuel Adams Light. Gold Medal	3.50
179367	87 • Sprecher Brewing Co. (WI) Micro-Light. Silver Medal	4.20
179348	86 • Moosehead Breweries (Canada) Moose Light. Silver Medal	4.00
179520	86 • Spoetzl Brewery (TX) Light. Silver Medal	3.90
179321	83 • Sleeman Brewing & Malting Co. (Canada) Light Lager. Bronze Medal	4.00

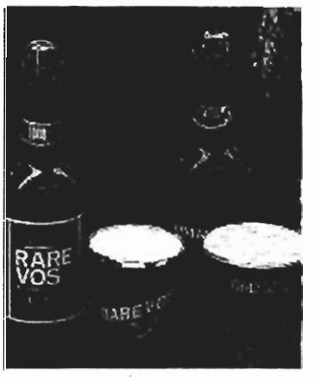
Mountain Jam
German Alps Festival
Intl. Celtic Festival
Microbrew & Wine Fest
Oktoberfest

Microbrew and Wine Festival

September 22 & 23, 2007
FREE Admission to the grounds
($15 fee for six beer or wine samples, includes souvenir glass)

2006 People's Choice Awards Winners:
- **Best Beer: Stone Mill Pale Ale - Green Valley Brewing - Merrimack, NH**
- **Best Brewery:** Butternuts Beer & Ale Co. **- Garrattsville, NY**
- **Best Winery: Red Barn Winery - North Syracuse, NY**

Saturday and Sunday, 12noon-5pm each day



The Skyride will be open!

Sample fine microbrews and wines of the Hudson Valley, New York State and beyond. There will be a variety of vendors offering specialty foods and delicacies, plus a variety of arts and crafts vendors, a farmers market, live entertainment and more. Admission to the grounds is free; there will be a $15 per day fee for beer or wine tasting, which includes six tastings and a souvenir beer or wine glass.

The following breweries and wineries are scheduled to attend:

Breweries
- Butternuts Beer & Ale
- Brewery Ommegang
- Brooklyn Brewery
- Sleeman Brewing
- Redhook Ale Brewery
- Brown's Brewing
- Ithaca Beer co.
- Albany Pump Station
- Lake Placid Brewing
- Ramapo Valley Brewery
- Anchor Brewing
- Saranac
- Keegan Ales
- Olde Saratoga Brewing
- Gilded Otter Brewing

Wineries

- Poplar Ridge Vineyards
- Hazlitt 1852 Vineyards
- Americana Vineyards

- Cascade Mtn Winery
- Red Barn Winery
- Miceli Vineyards
- Ashley Lynn Winery
- Brotherhood Winery
- Warwick Valley Winery
- Long Island Meadery
- Baldwin Vineyards
- Thousand Island Winery

2000 James Beard Foundation Journalism Award Winner
Newspaper Writing on Spirits, Wine and Beer

Altanta Journal-Constitution, Thursday, Aug. 26, 1999

Experiments with Hops, A Welcome Development

By Michael Skube

When Flemish weavers traveled to England early in the 16th century, they brought more than wool to barter. They also brought hop varieties they had been using to brew beer.

Hops, as Jim Dorsch tells us in Beer Connoisseur magazine, have had myriad uses since ancient times, from baking to medicine. But they are a comparative newcomer to brewing, and the English at first rejected the plant as "a pernicious weed." Their emphatic disapproval moved Henry VIII — whose way of settling matters could be swift and final — to ban them from the kingdom. Not until Edward VI rescinded the edict later in the century did English brewers gradually come to see hops' value, first as a preservative but eventually as beer's defining spice.

"To brew beer without hops," Dorsch writes, "would be like cooking soup without seasoning. Hop bitterness mitigates the sweetness of malt. Hop oils give beer flavors and scents redolent of pine, citrus, flowers, and herbs."

With the craft brewing movement, hops are being discovered in all their variety, from the softly floral notes of the classic Saaz to the assertive citrus character of Cascade and Centennial hops. Even the biggest brewers — who long ago diluted their flagship beers to the point where neither malt nor hops could be detected — are catching on. Anheuser-Busch's Michelob Pale Ale is a case in point, albeit an unadventurous one.

Ales, the family of beers whose heritage reaches back to England and Belgium, are distinguished from lagers in certain basic ways, and one of them is the hops. British ales traditionally have used East Kent Goldings and Fuggles hops to impart the flavor and aroma. When American craft brewers began to brew assertive ales in the 1980s, they used domestic hops, notably the Cascade, to achieve a distinctively different, Pacific Northwest character.

But in neither a British nor an American ale would you expect to find the Saaz hop, the Hallertau or the Tettnang, the so-called noble hops used in German lagers.

"Why do lagers tend to be made with...Hallertau, Saaz, Tettnang and Spalt, while British ales seem to taste best with Fuggles or Goldings?" Dorsch asks. "It's hard to say." Some variables can be measured, but in the end it's still a mystery." As a rule, German hops are flowery and perfumey, while such American varieties as Cascade, Centennial and Chinook have a piney or citrusy character. Different from both the American and German hops, English Fuggles and East Kent Goldings tend to be herbel and earthy.

So here is Michelob Pale Ale, brewed from top-fermenting ale yeast, seasoned not with hops you'd expect, but the hops found in Czech and German lagers. It's even dry-hopped — an extra step the world's largest brewery has undertaken in emulation of smaller craft breweries — and the results are, well, not bad. This is easily the best beer Anheuser-Busch makes.

If this sounds like damning with faint praise, you need to set this well-made beer alongside two others that aim for the middle of the road. I chose Celis' Pale Rider and New Amsterdam India Pale Ale, beers from well-regarded craft breweries. In the case of Celis, you even had the authority of Clint Eastwood.

"We are honored," the label says, "to bring you Pale Rider, proudly brewed for Clint Eastwood

BREWINGTECHNIQUES

The Essential Oil of Hops: Aroma and Flavor in Hops and Beer

by Glenn Tinseth

Republished from BrewingTechniques' January/February 1994.

The quest for elusive hop character in beer has led researchers and brewers to break fertile ground in the discovery and control of the components that contribute flavor and aroma. A review of current research and brewing practice reveals the nature of hop aroma and guides brewers in optimizing the use of hops to achieve the desired character of finished beer.

The female flower of the hop plant *(Humulus lupulus)* has long been a friend to beer brewers around the world. Depending on the style of beer, hops can add balance to the finished product through bitterness, flavor, and aroma. The contribution of bitterness in the finished product through the isomerization of a-acids is well documented, but investigations into the chemistry and utilization of hop essential oils for beer flavor and aroma have, in general, failed to elucidate the complex processes involved. This article focuses on the essential oil of hops, providing background on the chemistry and composition of hop oil in hops and beer and discussing practical methods of evaluating and analyzing hops for the aromatic quality of hop essential oil. I include some methods of obtaining and protecting hop flavor and aroma in finished beer, which I think is the most important take-home message of all.

Most dedicated small-scale brewers are familiar with the wide variety of hop products available for use in brewing. The starting point for all of these is the whole, unprocessed hop flower. Hop flowers are harvested once a year (in late August and early September), processed, packaged, and held in cold storage until sold. Various levels and intensities of processing result in various end products, including Type 100 pellets (highly compressed whole cones in 1/2-oz plugs), Type 90 pellets (ground whole cones extruded into pellets), and a variety of purified and concentrated extracts and essences.

In most cases trade-offs arise when choosing among product types, especially when the brewer is concerned with hop essential oils. These trade-offs are roughly proportionate to the intensity of processing. Each product type makes a slightly different contribution to beer, providing brewers various avenues for introducing hop character into their products.

The various hop extracts and essences available give brewers even more choices of when to add hop compounds. Some British brewers have abandoned dry hopping in favor of postfermentation additions of

concentrated hop oil. The hop oil extracts available today that are produced using liquid carbon dioxide are much higher in quality than the extracts of the past that were made using solvents, and they are free from the problem of solvent (hexane) contamination.

By far the most common way that hops are used is to add them to the brew kettle and boil them in sweet wort. In long boils (30-120 min), hops accomplish four primary functions: they add bitterness through the isomerization (rearrangement without change of composition) of a-acids into more stable and soluble iso-a-acids; they assist in the production of a good hot break by supplying tannins that combine with unwanted proteins; they add to beer stability by virtue of their antibacterial properties; and they lower the surface tension of the wort so that a vigorous boil can be more easily maintained.

Late kettle additions (0-30 min before knockout) are responsible for most of the "hop character" of a beer, or the hop flavor and aroma that result from the contribution of hop essential oils. Even more hop oil can be introduced into the wort by running hot wort through a bed of hops on the way to the chiller (using a hop back, or hop jack, for example). Dry hopping - adding hops to the fermentor or serving tank - also adds more hop character, though the compounds extracted by cool wort or beer are quite different from those found in wort immediately after the boil.

In a nutshell, hop character is affected both by the type of hop product you add to the wort or beer and by the method and timing of the addition. This variation is due in part to the vast array of highly reactive compounds that make up hop oil.

The aromatic and Flavor constituents of Hops

Most plant materials contain two groups of oils, differentiated by their volatility. The fixed oils, like liquid fats found in nuts, are relatively nonvolatile and contribute little to aroma. The volatile oils, also called essential oils, are so easily vaporizable that we can deduce their presence or absence simply by using our noses.

We are all familiar with perfumes and spices, both of which are loaded with either naturally occurring or synthesized essential oils. In hops, the essential oil makes up only about 0.5-3% (v/w) of the whole cone, but its contribution to beer is enormous. Consider the following: If a typical beer uses hops at a rate of 0.5 oz/gal, and we assume that the oils are 10% utilized, then the hop oils ending up in the finished beer are <0.001% (w/w) (10 ppm). Yet what is the first thing that hits the nose in a Cascade dry-hopped American pale ale? Its big floral aroma is impossible to miss. A brief examination of the chemistry of hop essential oil can explain that big impression.

Hop oils are made up primarily of a hydrocarbon fraction (which contains only hydrogen and carbon) and an oxygenated fraction (which contains hydrogen, carbon, and oxygen). Hop oils also contain small amounts of sulfur-containing compounds, but these are outside the scope of this

article. The hydrocarbons typically make up 80-90% of the total oil content; the terpenes myrcene and b-pinene and the sesquiterpenes b-caryophyllene and a-humulene are the most prevalent constituents. Two of these, b-caryophyllene and a-humulene can be easily oxidized in air, thus contributing to the oxygenated fraction of the oil as well (1). Other oxygenated compounds include alcohols such as linalool and geraniol and esters such as geranyl isobutyrate and methyl dec-4-enoate (2-5). Although many brewers think that all esters are by-products of fermentation, hops can contribute a number of fruity aromas (grapefruit and pineapple, for example).

Determining "Hoppiness"

Some brewers have asked the question, "Why hasn't anyone tried to quantify the 'hoppiness' of a given hop sample like they have its bitterness (which is based on percent a-acid content)?" Because hop character is attributable to hop essential oil, one would think that the amount of oil in a hop sample would provide a means of estimating its hop aroma content. Unfortunately, the issue is not simple (6).

A hop's total oil content can indicate the overall quality of a hop sample, especially if you have a good idea what the normal oil content for that hop should be. This method may be valuable if you are buying hops from afar, sight-unseen. But because many factors affect essential oil production and preservation, every season holds the potential for significant variation in both the total amount of oil and the composition of the oil, even for a single variety. In fact, substantial differences can be detected from farm to farm, not to mention the additional variables introduced by hop processing and storage facilities. Over the period 1975- 1985, the total oil content of fresh Cascade hop samples studied at the USDA Hop Research Laboratory at Oregon State University (Corvallis) varied between 0.28 and 1.79 mL/100 g of hops; the percent myrcene, an inert component (usually the major hydrocarbon component) in the oil which has no effect on aroma potential, ranged from 46% to 82% (7). The total oil rating, therefore, does not necessarily provide useful information about the composition of the oil and thus cannot provide the information needed to evaluate the aroma quality of our hops. Three other methods, however, have proven to be quite helpful.

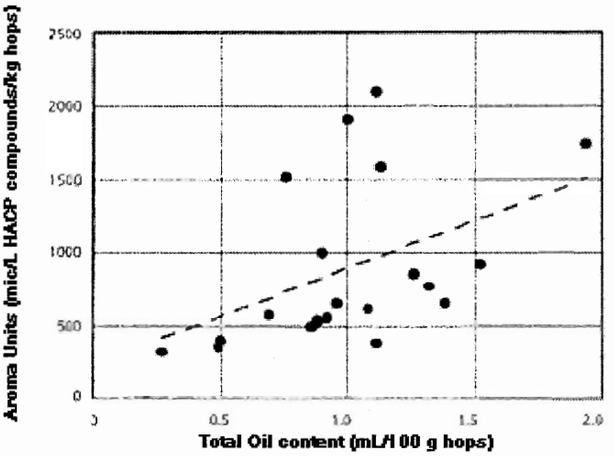
High tech. A high-tech method gives both quantitative and qualitative information but requires distillation equipment and a capillary gas chromatograph. The gas chromatograph has helped researchers to identify more than 250 essential oil components. Of these, 22 have been reported to affect hop aroma, and they have been divided into groups: humulene and caryophyllene oxidation products, floral-estery compounds, and citrus-piney compounds. These 22 compounds make up the hop aroma component profile (HACP) and are listed in Table I (7).

Just as bitterness in beer is quantified using the bittering unit (BU), Nickerson and Van Engel propose that an aroma unit (AU) be adopted. They define the AU as the sum of the 22 HACP constituents, measured in parts per million (µL/kg of hops or µL/L of wort or beer). Thus, if the

AUs of a brewery's aroma hops were to change, the brewery would need only to calculate the change in the amount of hops needed to achieve the historical AUs of a given beer.

How well do AUs correlate with actual 'hoppiness'? A commercial brewery's taste panel found that hop aroma, hop taste, and dry hop aroma correlated very well with AUs (8). Using data from an earlier study (9), I checked to make sure that no more simple method was being overlooked; as a home brewer I didn't have a spare gas chromatograph laying around my basement. The data did show correlation between AUs and the total oil content in fresh hops, though the correlation was relatively weak (r = 0.449) (10), ranking only about a 3 on a scale of 1-10 (see Figure 1).

Fig.1 Plot of aroma units versus total oil content in fresh hops. Coefficient of variations *(r)*=0.449.



The correlation was better in hops aged for six months at room temperature (r = 0.756), but it is ill-advised for anyone to brew with hops that have been subject to such storage conditions. These data confirm the hypothesis that total oil content is not necessarily a good indicator of potential hoppiness or aroma quality. Also, I found no significant relationships between AUs and myrcene, humulene, or a-acid levels.

Low tech. For those of us without a complete lab at our disposal, a couple of tried and true low-tech (or no-tech) methods can be used for evaluating the aroma potential and quality of hops.

The first is initiated simply by grabbing a handful of hops and looking, listening, feeling, tasting, and smelling them. In reference to evaluating fine aroma hops, Jean De Clerk wrote, (11)

> "Aroma is tested by smelling a crushed handful of whole cones. The hops should have a pronounced aromatic smell free from extraneous taints and odors, [list of unpleasant odors]. . . . Smell may also be tested by rubbing the cones between the fingers, which splits the lupulin grains. The aroma of the sample should not be sharp, but fine and

mellow."

Although this sort of manual evaluation of hops will give you a good feel for the overall quality of the hop and its potential dry hop aroma, it provides little quantitative information. Most of what you will smell is the hydrocarbon fraction of the essential oil, and this fraction is rapidly lost during the boil or changed during fermentation and is, in fact, rarely found in beer (9). If after crushing the hops in your hands you pause for a minute or two to let the most volatile of the hydrocarbons dissipate, you will be better able to evaluate the aroma quality (6).

The second method is to make a hop tea by boiling or steeping a hop sample in water. The preparation process evaporates a significant portion of the hydrocarbons and gives you a better impression of how a particular sample will perform in the brew kettle. To be as consistent as possible, I recommend always making the tea in the same container (a 1-L Erlenmeyer flask is good) and using the same water-to-hop ratio (2 g hops/600 mL water) (12). Prepare the tea the same way you plan to use the hops in your beer, boiling (or steeping) for a predetermined time. After cooling the tea, add water to bring the volume back to your starting point and evaluate the flavor and aroma both for quality and quantity/intensity. Although this method uses no fancy instrumentation, it can be very effective, especially if good sampling notes are kept. More information about using hop teas to evaluate hop aroma will appear in a future issue of *BrewingTechniques*. Regardless of which low-tech method you use, if it smells bad, don't use it.

Hop essential oils, like hop bitter resins, are easily lost during storage due to their susceptibility to oxidation. Workers performing storage trials at the USDA Hop Research Laboratory determined that oil losses ranged from 28% to 90% after six months at room temperature, depending on the variety (9; see also article beginning on page 26 of this issue). These losses can be slowed by storing hops in the freezer, preferably in a package that allows no air or water exchange ("barrier packaging"). The best advice is to buy the best hops you can find and take good care of them, especially if they are aroma hops.

As mentioned above, the compounds found in hop oil are not all the same as those found in hopped beer. As many brewers already know, late kettle additions contribute different qualities than do steeped hops and dry hops. Fermentation and finishing processes also affect hop character. Consequently, a brewer needs to find the type of hop character desired and then be consistent in the method used to achieve it.

POSTFERMENTATION LOSSES

Once you have achieved the Holy Grail of hoppiness, and the bottle is capped or the keg is sealed, hop character begins its inevitable downhill slide. According to Peacock and Deinzer, the two main ways in which hop oil components in finished beer can be lost are migration into the packaging material and chemical degradation. They write (2),

> "The major mechanism for the loss of hop aroma compounds from beer appears to be chemical degradation. The most likely pathways for degradation of terpenoid and sesquiterpenoid compounds are reaction with oxygen in the headspace of the bottle and acid hydrolysis."

They go on to say that bottle cap liners tend to absorb many hop compounds, especially hydrocarbons and longer chain ketones and esters. Hop oil alcohols appear not to be absorbed well by cap liners. Because we can do nothing about acid hydrolysis, this diagnosis points to a rigorous elimination of oxygen from all beer packages and to the use of a nonabsorptive bottle cap liner. Oxygen scavenger caps are available (PureSeal, Zapata Technologies, Hazleton, Pennsylvania), but their performance with respect to absorption of hop oil compounds has not yet been tested.

Hop Aroma Made Simple

Four important points simplify dealing with hop essential oils. First, start with the best hops you can get and store them in the freezer in barrier packaging if possible. Second, monitor the aroma quality of your hops using either the aroma unit (if you can) or by physical evaluation. Third, be consistent in your brewing process, making adjustments based on your evaluations. Fourth, try to eliminate as much oxygen as possible from your packaging process. The last two points will yield benefits in other areas, increasing the pay-off of added care in these areas.

Hop oil research is a rapidly changing field, and new findings pop up every year. The consensus is that the marvelous hop aroma and flavor we all enjoy is probably due to a synergistic combination of hop oil compounds and their oxidation and fermentation products, some of which may not even have been discovered yet. One thing is certain: even though I may not know exactly what I am tasting in my dry-hopped IPA, I like it!

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(1) M. Verzele, in Brewing Science, vol. 1, J.R.A. Pollack, Ed. (Academic Press, London, 1979), p.311.

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(3) A. Murikami, S. Rader, E. Chicoye, and H. Goldstein, "Effect of Hopping on the Volatile Composition of Beer," J. Am. Soc. Brew. Chem. 47, 35 (1989).

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(5) G. Nickerson, P. Williams, and A. Haunold, "Composition of Male Hop Oil," J. Am. Soc. Brew. Chem. 46, 14 (1988).

(6) G. Nickerson, personal communication, 4 December 1993.

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(8) G. Nickerson and L. Van Engel, "Use of the Hop Aroma Component Profile to Calculate Hop Rates for Standardizing Aroma Units and Bitterness Units in Brewing," J. Am. Soc. Brew. Chem. 50, 82 (1992).

(9) R. Foster and G. Nickerson, "Changes in Hop Oil Content and Hoppiness Potential (Sigma) During Hop Aging," J. Am. Soc. Brew. Chem. 43, 127 (1985).

(10) T. Anderson and S. Sclove, The Statistical Analysis of Data (The Scientific Press, Palo Alto, California, 1986), p. 538.

(11) J. De Clerk, A Textbook of Brewing, vol. 1 (Chapman and Hill Ltd, London, 1958), p. 65.

(12) Dr. Hashimoto of Kirin Brewery Co. Ltd., Japan, "What are Aroma Hops?" typed manuscript delivered 11 August 1990 at Anheuser Busch, St. Louis, Missouri.

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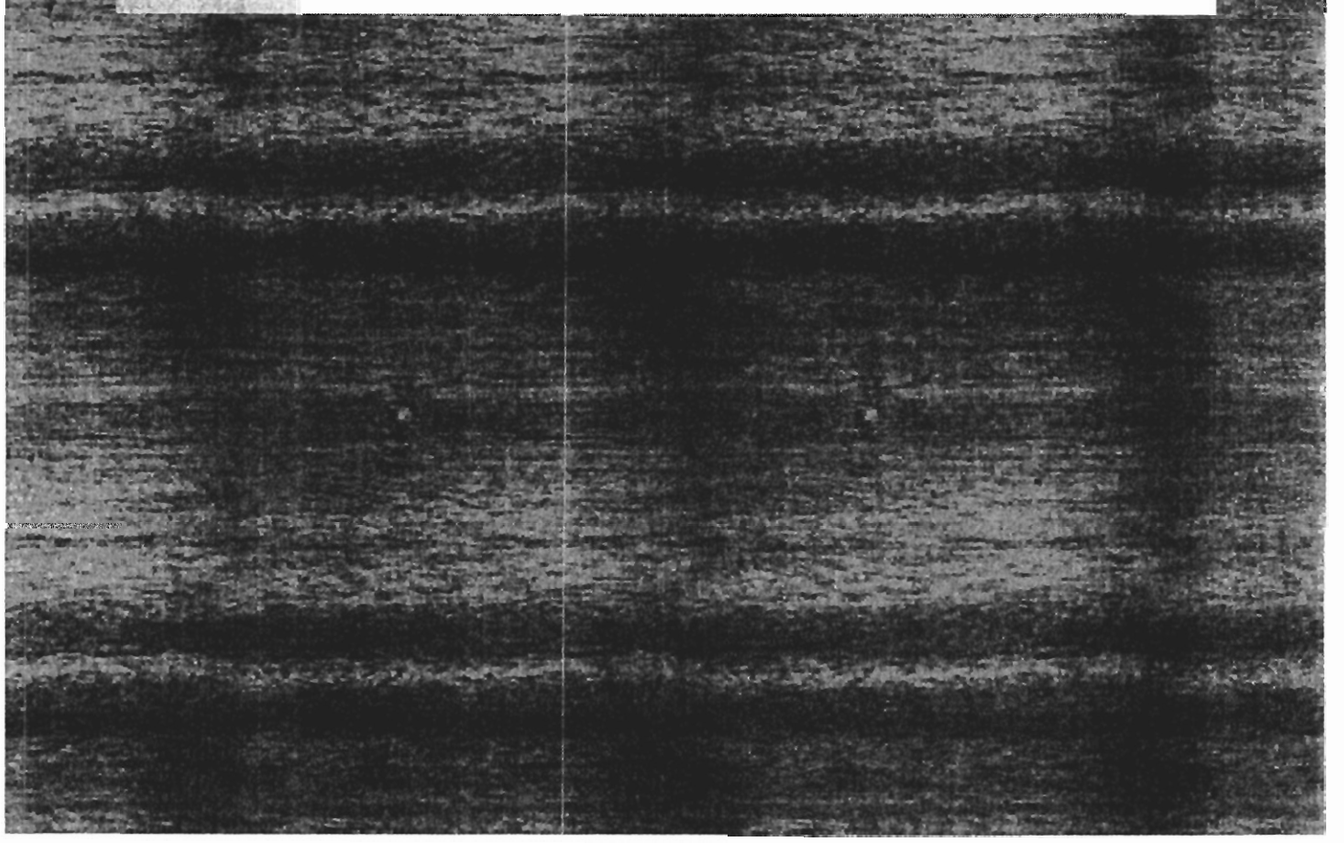

Using a warehouse print out of their current inventory as a guide, record and verify a physical count of all bales of hops of the selected variety. Take special care to distinguish not only the variety on the print out and in the warehouse but also the year of the crop. Each hop bale will have a code printed on it that is similar to the example below. Please note the following key components of the Hop Lot Identification Number:

Position:	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Lot #:	*2*	*3*	*2*	*D*	*S*	*A*	*6*	*1*	*0*	*5*	*0*	*0*	*9*	*L*

Position #1 – denotes crop year (Ex: 2 = 2002, 3 = 2003, etc…)

Position #2 – identifies country (2 = USA, 3 = Germany, 4 = France)

Position #3 – identifies growing region, for example:

If domestic, 1=Washington, 2=Oregon, 3=South ID, 4=North ID

If imported, 1 = Hallertau, 2 = Tettnang, 3 = Spalt

Position #4 – indicates whether the hops are (I) Imported or (D) Domestic

Position #5-7 – is the Variety Code, for example:

HAL = Hallertau variety

WIL = Willamette variety

GLA = Glacier variety

ALS = Alsace variety

CAS = Cascade variety

SA2 = Saaz 72, SA6 = Saaz 36, and SA8 = Saaz 38

Position #8-10 – denotes the Grower Code

Position #11-13 – denotes the Grower Lot Code

Position #14 – indicates the Package Size/Type as (L) Large, (S) Small, (P) Pellets

YC-T90 Hop Pellets

MATERIAL SAFETY DATA SHEET

MANUFACTURER: Yakima Chief, Inc.
P.O. BOX 209
555 W. South Hill Road
Sunnyside, WA 98944
USA
Tel.: +1.509.839.90.22
Fax: +1.509.839.55.70

SECTION I - PRODUCT IDENTIFICATION

PRODUCT NAME **YC- Type 90 Hop Pellets**

CHEMICAL NAME: Pellets made from ground raw hop cones.

CHEMICAL FAMILY: Raw Hop Cones

Hops fall under recognition by GRAS basis the general provisions of CFR 21, Part 182, Sec. 182.1.

SECTION II - MATERIAL or COMPONENTS

COMPOSITION: A solid pellet composed of ground hops, produced by pelleting milled whole hop cones.

HAZARDOUS COMPONENTS: Not Applicable
Product is natural, unrefined and contains no additives.

SECTION III - PHYSICAL DATA

BOILING POINT:	Not Applicable; Solid
FREEZING POINT:	Not Applicable; Solid
VAPOUR PRESSURE:	Not Applicable; Solid
VAPOUR DENSITY:	Not Applicable; Solid
SOLUBILITY IN WATER:	Insoluble
APPEARANCE & ODOUR:	Green pellets with an herbal, pungent odor.
SPECIFIC GRAVITY:	Not Applicable; Solid
PERCENT VOLATILE by VOLUME:	< 5%
EVAPORATION RATE:	Not Applicable; Solid

SECTION IV - FIRE & EXPLOSION

FLASH POINT:	Not Applicable
EXTINGUISHING MEDIA:	Water, CO_2
SPECIAL FIRE FIGHTING PROCEDURES:	None Required
UNUSUAL FIRE & EXPLOSION HAZARDS:	Spontaneously combustible when hot and wet or over dry (< 8% moisture) in an open container.

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE:	Not Established.
ORAL INGESTION:	Not applicable – Food product, very bitter, therefore unpalatable.
EYE CONTACT:	May be a mild irritant.
SKIN CONTACT:	Prolonged contact could cause dermatitis in some individuals.
INHALATION:	Dust generated during sweeping of spilled product may cause respiratory distress in some individuals.

EMERGENCY FIRST AID:

ORAL INGESTION:	Not Applicable
EYE CONTACT:	Wash with copious amounts of water. Seek medical attention if irritation persists.
SKIN CONTACT:	Wash with warm, soapy water. Seek medical attention if irritation persists. Launder contaminated clothing before reuse.
INHALATION:	Remove affected person to fresh air. Administer oxygen if necessary.

SECTION VI - SPILL or LEAK PROCEDURE

Steps to be taken in case material is released or spilled:

Scoop/shovel spilled material into recovery container. Flush area with hot soapy water to remove final traces. Use adequate ventilation or a respirator if in a confined area.

SECTION VII - SPECIAL PROTECTION

PROTECTIVE GLOVES:	Rubber (optional)
EYE PROTECTION:	Safety Glasses (optional)
RESPIRATORY:	Filter Mask (optional)

Back to YC-T90 Hop Pellets

Specs | MSDS

Hop Pellets (Type 90 Pellets)

Material Safety Data Sheet

1. Product and Supplier Information	
Name:	**Hop Pellets (Type 90 Pellets)**
Synonyms:	PEL/PE 90 Kettle Pellets, Hop Pellets
Supplier:	**Barth-Haas Group/Botanix Ltd.** The Moor, Eardiston, Tenbury Wells, Worcestershire, WR15 8JJ, UK Emergency phone:+44 1568 797 895 or 01584 875 395 Email: intray@botanix.co.uk **Barth-Haas Group/John I. Haas, Inc.** 5185 MacArthur Boulevard, N.W., Suite 300, Washington, DC, 20016 USA Emergency phone: +1 202 777 4800 Email: info@johnihaas.com **Barth-HaasGroup/** **Hopfenveredlung St. Johann GmbH & Co. KG** Mainburger Str. 15, 93558 St. Johann, Germany Emergency phone: +49 9444 878 0 E-mail: contact@hopfenveredlung.de
2. Components/Composition	
Product consists entirely of pelleted hop cones of the cultivated hop plant *Humulus lupulus*. Many different varieties.	
	Humulones (Alpha-acids) Lupulones (Beta-acids)
CAS number:	26472-41-3 468-28-0
3. Health Hazard Data	
Main hazards:	none
Oral ingestion:	associated dust may be irritating to mouth and throat
Eye contact:	associated dust may be irritating to eyes
Skin contact:	not applicable
4. Emergency and First Aid Procedures	
Eye contact:	Wash out with plenty of water.
Skin contact:	Brush off excess material and wash skin thoroughly with soap and water.
5. Fire and Explosion Hazard Data	
Extinguishing media:	Use dry powder, foam or carbon dioxide. Keep containers and surroundings cool with water spray.
Unsuitable extinguishing media:	Great care should be taken using water jet/spray.
Special hazards of product:	none

6. Accidental Release/Spill measures	
Personal protection:	Wear appropriate protective clothing.
Environmental precautions:	Do not allow product to enter drains.
Normal clean-up procedure as for any agricultural commodity.	
7. Handling and Storage	
Storage temperature	• 0-5 ℃ (32-41℉)
To guarantee quality avoid heat, moisture, strong odours during storage. Pellets should not be stored at temperatures above 20 ℃ (68 ° F) since it is possible that gases are formed from hop constituents. The resulting pressure increase may cause bursting of the foils. Consequently the pellets are exposed to air and oxidation takes place resulting in a considerable deterioration of quality. Suitable storage containers are thick gauge laminated foil bags, stainless steel and lacquered mild steel.	
8. Exposure Controls/Personal Protection	
Respirator:	If in danger of generating dust use facemask
Hand protection:	Not required
Body protection:	Not required
Eye protection:	If in danger of generating dust wear goggles
9. Physical and Chemical Properties	
Form:	Pelleted powder
Color:	Various shades of green
Odor:	Characteristic, typical hoppy
Boiling Point:	Not applicable
Density (kg/m^3):	480-700
Solubility in Water:	Insoluble in water
pH:	Not applicable
Flash point:	Not applicable
Evaporation Rate:	Not applicable
10. Stability and Reactivity	
Hop constituents oxidize in contact with air, no hazardous reactivity known. If originally sealed packages are stored at temperatures above 20 ℃ (68 ℉), gas formation is possible. Combustion will generate oxides of carbon.	
11. Toxicological Information	
Product is used for beer brewing and is generally recognized as safe (GRAS 21 CFR 182.20).	
12. Ecological Information	
The product is all natural and biodegradable.	
13. Disposal Considerations	
Product disposal:	Dispose of in accordance with all applicable local and national regulations.
Container disposal:	Labels should not be removed from containers until they have been cleaned. Contaminated containers should not be treated as household waste. Containers should be cleaned using appropriate methods and then re-used or disposed of by landfill or incineration as appropriate.

14. Transport Information	
UN-No: N/C	RID: N/C
Class: N/C	Packing Group: N/C
recommended Transport conditions:	Quickest possible transport at temperatures below 20 ℃ (68 ℉)
15. Regulatory Information	
Labeling according to EC directives	
R-phrases:	Not applicable
S-phrases:	Not applicable
Einecs Listing:	Not listed
16. Other Information	
The information in this Safety Data sheet is correct to the best of our knowledge. This information herein is furnished without warranty of any kind. This information should be used only as a supplement to information already in your possession concerning this product. The determination of whether and under what condition the product should be used by your employees is yours to make. We do not accept any liability for loss, injury or damage that may result from its use.	

Hops for Flavour

The world of wine has, since the 1990's, put great emphasis on the different flavours offered by each grape variety. This is because wine marketers believe that knowing what to expect from a grape variety is easier for a consumer to understand than attempting to know what to expect from a wine region or a country.

To be scurrilous, I occasionally ask wine panels to taste single grape varietal wines and then to write down which back label (i.e. tastes of blackcurrant and lemon over a bed of august elder flowers) refers to which wine. Invariably they get it wrong, which leads me to think that making taste claims for each hop variety is entirely legit.

Hops in the Pint

Hops have just as many flavour profiles and 'beauty spots' as grapes, but brewers in the 1970's and '80's used to blend hops together to achieve 'a consistent grist' rather than asking just one hop to show its individual beauty and character.

It is not to claim that single hop beers are better. They are just 'different'. But times have changed and there are now over 30 single hop varietal beers in Britain including award winners such as Fullers 1845 (Goldings); Hop Back's Summer Lightning (Goldings); Hogs Back's T.E.A (Goldings); Brakspear's Coniston Bluebird (Challenger), Adnams Broadside (First Gold) and Caledonian's Golden Promise (Target).

So what clues can you use to try to recognize each hop, in the knowledge that barley, yeast and water will do their best to influence the result?

The Fuggle was propagated in Kent in 1875 by Richard Fuggle It is very widely used traditional English ales and is frequently used alongside Goldings, for which it forms a perfect base. It has the advantage of being very low in alpha acids (c 50%) and yet it provides length, roundness and drinkability. Excellent in every style of ale, the Fuggle brings particular sensuality to porters and stouts. It is often used as a dry hop so as to bring together flavours and provide character. Flavours attributed to it are: earthy, grassy, sensuous, moreish. Single hop

varietal examples are:-

- Whitbread's Fuggles Imperial
- Chiltern Brewery's John Hampden's Ale
- George Gale's Prize Old Ale
- McMullen's Gladstone bitter.

Goldings, first developed in the 1700's, consist of a group of traditional English hop varieties, including Amos' Early Bird, Cobbs, Canterbury, Eastwell, Golding, Bramling and Mathon. The Golding is often described as 'quintessentially English'. It is usefully low in alpha acid (c 5.5%) and very versatile. Historically, it has often been used in a blend with the Fuggle to which it often adds a delicate citrus edge. More recently, the Golding is being used increasingly for 'single hop varietal' beers and in some wheat beers. Adjectives used to describe it include citrus sweet, lemon, floral, violets, apricot. Used in greater concentration, or as a dry hop, it provides a rich orange, marmalade character. Single varietal beers include:-

- Hop Back's Summer Lightning
- Fuller's 1845
- Fuller's India Pale Ale
- Frederic Robinson's Frederic's Premium
- JW Lee's Bitter
- the Award-winning Hog's Back's T.E.A

First Gold is one of England's revolutionary new dwarf hop varieties. It is a cross between Whitbread's Golding variety and a dwarf male and has many of the Golding's flavour characteristics, but with a higher alpha acid (c 8.5%). The hop gives a rich, citrus character to beers, with orange peel and dried apricot. A very adaptable. all round hop for fruity bitters, ales, stronger flavoured summer beers and IPAs. Beers which use this hop assertively include:-

- Adnam's bottled Broadside IPA
- Young's First Gold
- Freeminer's Gold Standard.

Bramling Cross, bred in 1927, is a cross between a Bramling (Golding) mother and a wild Manitoban male. The eccentricity of the Manitoban gives beers a blackcurrant and lemon quality which is exciting when carefully handled. Alternatively, Bramling Cross can provide a sweet creamy drinkability. This hop should be excellent for spiced beers, Christmas beer, fruit beers. curry beer, as well as having potential for winter and summer wheat beers. Very few overtly Bramling Cross beers yet exist.

The Target hop was bred by HRI-Wye in 1972 as

a bittering hop, with alpha acid of around 11%. However its flavour characteristics have out performed expectations. Although many brewers regard it as a difficult hop, those who have persevered manage to obtain flavours ranging from orange, to marmalade, to peppery geranium. Target has been used as a single varietal in:-

- Caledonian's award winning Golden Promise
- Usher's Lal Toofan lager
- Hardy and Hanson's prize winning Guzzling Goose Bitter which uses Target both in the copper and as a dry hop.

W G V (Whitbread Goldings Variety) Bred in 191I in Kent and first promoted in the I930s both for its flavour and disease resistance qualities This Goldings relation gives a citric, lightly fragrant aroma and flavour best suited to pale ales, light bitters and wheat beers, Used as a single varietal in McMullen's AK original.

The Progress hop was developed by HRI-Wye in 1951, a daughter of the Whitbread Golding Variety, to provide a wilt tolerant alternative to the Fuggle, It has alpha acid at c 6% and a slightly sweet sometimes lime fruit character. Excellent for pale ales, lighter bitters, wheat beers and porters. It has been used as a 100% varietal in:-

- Hop Back's Thunderstorm
- Wood Brewery's Hopping Mad

Wye Challenger and Wye Northdown: Both these hops are 'dual purpose' hops with alpha acid of about 8%. They give a full fruit palate and considerable breadth of flavour. Challenger in particular has produced award winning single varietal beers, Single varietal examples include:-

- St Peter's Strong ale
- Swale's Old Dick
- Wychwood's Old Devil
- B&T's Old Bat
- and, the all-conquering Brakspear's Coniston Bluebird

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level of PCB's as adulterated in violation of sec. 402 of the act.

Subpart C—Regulatory Limits for Added Poisonous or Deleterious Substances [Reserved]

Subpart D—Naturally Occurring Posionous or Deleterious Substances [Reserved]

PART 110—CURRENT GOOD MANUFACTURING PRACTICE IN MANUFACTURING, PACKING, OR HOLDING HUMAN FOOD

Subpart A—General Provisions

Subpart B—Buildings and Facilities

Subpart C—Equipment

Subpart D [Reserved]

Subpart E—Production and Process Controls

Subpart F [Reserved]

Subpart G—Defect Action Levels

AUTHORITY: 21 U.S.C. 342, 371, 374; 42 U.S.C. 264.

SOURCE: 51 FR 24475, June 19, 1986, unless otherwise noted.

Subpart A—General Provisions

§ 110.3 Definitions.

The definitions and interpretations of terms in section 201 of the Federal Food, Drug, and Cosmetic Act (the act) are applicable to such terms when used in this part. The following definitions shall also apply:

(a) *Acid foods or acidified foods* means foods that have an equilibrium pH of 4.6 or below.

(b) *Adequate* means that which is needed to accomplish the intended purpose in keeping with good public health practice.

(c) *Batter* means a semifluid substance, usually composed of flour and other ingredients, into which principal components of food are dipped or with which they are coated, or which may be used directly to form bakery foods.

(d) *Blanching*, except for tree nuts and peanuts, means a prepackaging heat treatment of foodstuffs for a sufficient time and at a sufficient temperature to partially or completely inactivate the naturally occurring enzymes and to effect other physical or biochemical changes in the food.

(e) *Critical control point* means a point in a food process where there is a high probability that improper control may cause, allow, or contribute to a hazard or to filth in the final food or decomposition of the final food.

(f) *Food* means food as defined in section 201(f) of the act and includes raw materials and ingredients.

(g) *Food-contact surfaces* are those surfaces that contact human food and those surfaces from which drainage onto the food or onto surfaces that contact the food ordinarily occurs during the normal course of operations. "Food-contact surfaces" includes utensils and food-contact surfaces of equipment.

(h) *Lot* means the food produced during a period of time indicated by a specific code.

(i) *Microorganisms* means yeasts, molds, bacteria, and viruses and includes, but is not limited to, species having public health significance. The term "undesirable microorganisms" includes those microorganisms that are of public health significance, that subject food to decomposition, that indicate that food is contaminated with filth, or that otherwise may cause food to be adulterated within the meaning of the act. Occasionally in these regulations, FDA used the adjective "microbial" instead of using an adjectival

phrase containing the word microorganism.

(j) *Pest* refers to any objectionable animals or insects including, but not limited to, birds, rodents, flies, and larvae.

(k) *Plant* means the building or facility or parts thereof, used for or in connection with the manufacturing, packaging, labeling, or holding of human food.

(l) *Quality control operation* means a planned and systematic procedure for taking all actions necessary to prevent food from being adulterated within the meaning of the act.

(m) *Rework* means clean, unadulterated food that has been removed from processing for reasons other than insanitary conditions or that has been successfully reconditioned by reprocessing and that is suitable for use as food.

(n) *Safe-moisture level* is a level of moisture low enough to prevent the growth of undesirable microorganisms in the finished product under the intended conditions of manufacturing, storage, and distribution. The maximum safe moisture level for a food is based on its water activity (a_w). An a_w will be considered safe for a food if adequate data are available that demonstrate that the food at or below the given a_w will not support the growth of undesirable microorganisms.

(o) *Sanitize* means to adequately treat food-contact surfaces by a process that is effective in destroying vegetative cells of microorganisms of public health significance, and in substantially reducing numbers of other undesirable microorganisms, but without adversely affecting the product or its safety for the consumer.

(p) *Shall* is used to state mandatory requirements.

(q) *Should* is used to state recommended or advisory procedures or identify recommended equipment.

(r) *Water activity* (a_w) is a measure of the free moisture in a food and is the quotient of the water vapor pressure of the substance divided by the vapor pressure of pure water at the same temperature.

§ 110.5 Current good manufacturing practice.

(a) The criteria and definitions in this part shall apply in determining whether a food is adulterated (1) within the meaning of section 402(a)(3) of the act in that the food has been manufactured under such conditions that it is unfit for food; or (2) within the meaning of section 402(a)(4) of the act in that the food has been prepared, packed, or held under insanitary conditions whereby it may have become contaminated with filth, or whereby it may have been rendered injurious to health. The criteria and definitions in this part also apply in determining whether a food is in violation of section 361 of the Public Health Service Act (42 U.S.C. 264).

(b) Food covered by specific current good manufacturing practice regulations also is subject to the requirements of those regulations.

§ 110.10 Personnel.

The plant management shall take all reasonable measures and precautions to ensure the following:

(a) *Disease control.* Any person who, by medical examination or supervisory observation, is shown to have, or appears to have, an illness, open lesion, including boils, sores, or infected wounds, or any other abnormal source of microbial contamination by which there is a reasonable possibility of food, food-contact surfaces, or food-packaging materials becoming contaminated, shall be excluded from any operations which may be expected to result in such contamination until the condition is corrected. Personnel shall be instructed to report such health conditions to their supervisors.

(b) *Cleanliness.* All persons working in direct contact with food, food-contact surfaces, and food-packaging materials shall conform to hygienic practices while on duty to the extent necessary to protect against contamination of food. The methods for maintaining cleanliness include, but are not limited to:

(1) Wearing outer garments suitable to the operation in a manner that protects against the contamination of food, food-contact surfaces, or food-packaging materials.

(2) Maintaining adequate personal cleanliness.

(3) Washing hands thoroughly (and sanitizing if necessary to protect against contamination with undesirable microorganisms) in an adequate hand-washing facility before starting work, after each absence from the work station, and at any other time when the hands may have become soiled or contaminated.

(4) Removing all unsecured jewelry and other objects that might fall into food, equipment, or containers, and removing hand jewelry that cannot be adequately sanitized during periods in which food is manipulated by hand. If such hand jewelry cannot be removed, it may be covered by material which can be maintained in an intact, clean, and sanitary condition and which effectively protects against the contamination by these objects of the food, food-contact surfaces, or food-packaging materials.

(5) Maintaining gloves, if they are used in food handling, in an intact, clean, and sanitary condition. The gloves should be of an impermeable material.

(6) Wearing, where appropriate, in an effective manner, hair nets, headbands, caps, beard covers, or other effective hair restraints.

(7) Storing clothing or other personal belongings in areas other than where food is exposed or where equipment or utensils are washed.

(8) Confining the following to areas other than where food may be exposed or where equipment or utensils are washed: eating food, chewing gum, drinking beverages, or using tobacco.

(9) Taking any other necessary precautions to protect against contamination of food, food-contact surfaces, or food-packaging materials with microorganisms or foreign substances including, but not limited to, perspiration, hair, cosmetics, tobacco, chemicals, and medicines applied to the skin.

(c) *Education and training.* Personnel responsible for identifying sanitation failures or food contamination should have a background of education or experience, or a combination thereof, to provide a level of competency necessary for production of clean and safe food. Food handlers and supervisors should receive appropriate training in proper food handling techniques and food-protection principles and should be informed of the danger of poor personal hygiene and insanitary practices.

(d) *Supervision.* Responsibility for assuring compliance by all personnel with all requirements of this part shall be clearly assigned to competent supervisory personnel.

[51 FR 24475, June 19, 1986, as amended at 54 FR 24892, June 12, 1989]

§ 110.19 Exclusions.

(a) The following operations are not subject to this part: Establishments engaged solely in the harvesting, storage, or distribution of one or more "raw agricultural commodities," as defined in section 201(r) of the act, which are ordinarily cleaned, prepared, treated, or otherwise processed before being marketed to the consuming public.

(b) FDA, however, will issue special regulations if it is necessary to cover these excluded operations.

Subpart B—Buildings and Facilities

§ 110.20 Plant and grounds.

(a) *Grounds.* The grounds about a food plant under the control of the operator shall be kept in a condition that will protect against the contamination of food. The methods for adequate maintenance of grounds include, but are not limited to:

(1) Properly storing equipment, removing litter and waste, and cutting weeds or grass within the immediate vicinity of the plant buildings or structures that may constitute an attractant, breeding place, or harborage for pests.

(2) Maintaining roads, yards, and parking lots so that they do not constitute a source of contamination in areas where food is exposed.

(3) Adequately draining areas that may contribute contamination to food by seepage, foot-borne filth, or providing a breeding place for pests.

(4) Operating systems for waste treatment and disposal in an adequate manner so that they do not constitute a source of contamination in areas where food is exposed.

If the plant grounds are bordered by grounds not under the operator's control and not maintained in the manner described in paragraph (a) (1) through (3) of this section, care shall be exercised in the plant by inspection, extermination, or other means to exclude pests, dirt, and filth that may be a source of food contamination.

(b) *Plant construction and design.* Plant buildings and structures shall be suitable in size, construction, and design to facilitate maintenance and sanitary operations for food-manufacturing purposes. The plant and facilities shall:

(1) Provide sufficient space for such placement of equipment and storage of materials as is necessary for the maintenance of sanitary operations and the production of safe food.

(2) Permit the taking of proper precautions to reduce the potential for contamination of food, food-contact surfaces, or food-packaging materials with microorganisms, chemicals, filth, or other extraneous material. The potential for contamination may be reduced by adequate food safety controls and operating practices or effective design, including the separation of operations in which contamination is likely to occur, by one or more of the following means: location, time, partition, air flow, enclosed systems, or other effective means.

(3) Permit the taking of proper precautions to protect food in outdoor bulk fermentation vessels by any effective means, including:

(i) Using protective coverings.

(ii) Controlling areas over and around the vessels to eliminate harborages for pests.

(iii) Checking on a regular basis for pests and pest infestation.

(iv) Skimming the fermentation vessels, as necessary.

(4) Be constructed in such a manner that floors, walls, and ceilings may be adequately cleaned and kept clean and kept in good repair; that drip or condensate from fixtures, ducts and pipes does not contaminate food, food-contact surfaces, or food-packaging materials; and that aisles or working spaces are provided between equipment and walls and are adequately unobstructed and of adequate width to permit employees to perform their duties and to protect against contaminating food or food-contact surfaces with clothing or personal contact.

(5) Provide adequate lighting in hand-washing areas, dressing and locker rooms, and toilet rooms and in all areas where food is examined, processed, or stored and where equipment or utensils are cleaned; and provide safety-type light bulbs, fixtures, skylights, or other glass suspended over exposed food in any step of preparation or otherwise protect against food contamination in case of glass breakage.

(6) Provide adequate ventilation or control equipment to minimize odors and vapors (including steam and noxious fumes) in areas where they may contaminate food; and locate and operate fans and other air-blowing equipment in a manner that minimizes the potential for contaminating food, food-packaging materials, and food-contact surfaces.

(7) Provide, where necessary, adequate screening or other protection against pests.

§ 110.35 Sanitary operations.

(a) *General maintenance.* Buildings, fixtures, and other physical facilities of the plant shall be maintained in a sanitary condition and shall be kept in repair sufficient to prevent food from becoming adulterated within the meaning of the act. Cleaning and sanitizing of utensils and equipment shall be conducted in a manner that protects against contamination of food, food-contact surfaces, or food-packaging materials.

(b) *Substances used in cleaning and sanitizing; storage of toxic materials.* (1) Cleaning compounds and sanitizing agents used in cleaning and sanitizing procedures shall be free from undesirable microorganisms and shall be safe and adequate under the conditions of use. Compliance with this requirement may be verified by any effective means including purchase of these substances under a supplier's guarantee or certification, or examination of these substances for contamination. Only the following toxic materials may be used or stored in a plant where food is processed or exposed:

(i) Those required to maintain clean and sanitary conditions;

(ii) Those necessary for use in laboratory testing procedures;

(iii) Those necessary for plant and equipment maintenance and operation; and

(iv) Those necessary for use in the plant's operations.

(2) Toxic cleaning compounds, sanitizing agents, and pesticide chemicals shall be identified, held, and stored in a manner that protects against contamination of food, food-contact surfaces, or food-packaging materials. All relevant regulations promulgated by other Federal, State, and local government agencies for the application, use, or holding of these products should be followed.

(c) *Pest control.* No pests shall be allowed in any area of a food plant. Guard or guide dogs may be allowed in some areas of a plant if the presence of the dogs is unlikely to result in contamination of food, food-contact surfaces, or food-packaging materials. Effective measures shall be taken to exclude pests from the processing areas and to protect against the contamination of food on the premises by pests. The use of insecticides or rodenticides is permitted only under precautions and restrictions that will protect against the contamination of food, food-contact surfaces, and food-packaging materials.

(d) *Sanitation of food-contact surfaces.* All food-contact surfaces, including utensils and food-contact surfaces of equipment, shall be cleaned as frequently as necessary to protect against contamination of food.

(1) Food-contact surfaces used for manufacturing or holding low-moisture food shall be in a dry, sanitary condition at the time of use. When the surfaces are wet-cleaned, they shall, when necessary, be sanitized and thoroughly dried before subsequent use.

(2) In wet processing, when cleaning is necessary to protect against the introduction of microorganisms into food, all food-contact surfaces shall be cleaned and sanitized before use and after any interruption during which the food-contact surfaces may have become contaminated. Where equipment and utensils are used in a continuous production operation, the utensils and food-contact surfaces of the equipment shall be cleaned and sanitized as necessary.

(3) Non-food-contact surfaces of equipment used in the operation of food plants should be cleaned as frequently as necessary to protect against contamination of food.

(4) Single-service articles (such as utensils intended for one-time use, paper cups, and paper towels) should be stored in appropriate containers and shall be handled, dispensed, used, and disposed of in a manner that protects against contamination of food or food-contact surfaces.

(5) Sanitizing agents shall be adequate and safe under conditions of use. Any facility, procedure, or machine is acceptable for cleaning and sanitizing equipment and utensils if it is established that the facility, procedure, or machine will routinely render equipment and utensils clean and provide adequate cleaning and sanitizing treatment.

(e) *Storage and handling of cleaned portable equipment and utensils.* Cleaned and sanitized portable equipment with food-contact surfaces and utensils should be stored in a location and manner that protects food-contact surfaces from contamination.

[51 FR 24475, June 19, 1986, as amended at 54 FR 24892, June 12, 1989]

§ 110.37 Sanitary facilities and controls.

Each plant shall be equipped with adequate sanitary facilities and accommodations including, but not limited to:

(a) *Water supply.* The water supply shall be sufficient for the operations intended and shall be derived from an adequate source. Any water that contacts food or food-contact surfaces shall be safe and of adequate sanitary quality. Running water at a suitable temperature, and under pressure as needed, shall be provided in all areas where required for the processing of food, for the cleaning of equipment, utensils, and food-packaging materials, or for employee sanitary facilities.

(b) *Plumbing.* Plumbing shall be of adequate size and design and adequately installed and maintained to:

(1) Carry sufficient quantities of water to required locations throughout the plant.

(2) Properly convey sewage and liquid disposable waste from the plant.

(3) Avoid constituting a source of contamination to food, water supplies, equipment, or utensils or creating an unsanitary condition.

(4) Provide adequate floor drainage in all areas where floors are subject to flooding-type cleaning or where normal operations release or discharge water or other liquid waste on the floor.

(5) Provide that there is not backflow from, or cross-connection between, piping systems that discharge waste water or sewage and piping systems that carry water for food or food manufacturing.

(c) *Sewage disposal.* Sewage disposal shall be made into an adequate sewerage system or disposed of through other adequate means.

(d) *Toilet facilities.* Each plant shall provide its employees with adequate, readily accessible toilet facilities. Compliance with this requirement may be accomplished by:

(1) Maintaining the facilities in a sanitary condition.

(2) Keeping the facilities in good repair at all times.

(3) Providing self-closing doors.

(4) Providing doors that do not open into areas where food is exposed to airborne contamination, except where alternate means have been taken to protect against such contamination (such as double doors or positive air-flow systems).

(e) *Hand-washing facilities.* Hand-washing facilities shall be adequate and convenient and be furnished with running water at a suitable temperature. Compliance with this requirement may be accomplished by providing:

(1) Hand-washing and, where appropriate, hand-sanitizing facilities at each location in the plant where good sanitary practices require employees to wash and/or sanitize their hands.

(2) Effective hand-cleaning and sanitizing preparations.

(3) Sanitary towel service or suitable drying devices.

(4) Devices or fixtures, such as water control valves, so designed and constructed to protect against recontamination of clean, sanitized hands.

(5) Readily understandable signs directing employees handling unproteced food, unprotected food-packaging materials, of food-contact surfaces to wash and, where appropriate, sanitize their hands before they start work, after each absence from post of duty, and when their hands may have become soiled or contaminated. These signs may be posted in the processing room(s) and in all other areas where employees may handle such food, materials, or surfaces.

(6) Refuse receptacles that are constructed and maintained in a manner that protects against contamination of food.

(f) *Rubbish and offal disposal.* Rubbish and any offal shall be so conveyed, stored, and disposed of as to minimize the development of odor, minimize the potential for the waste becoming an attractant and harborage or breeding place for pests, and protect against contamination of food, food-contact surfaces, water supplies, and ground surfaces.

Subpart C—Equipment

§ 110.40 Equipment and utensils.

(a) All plant equipment and utensils shall be so designed and of such material and workmanship as to be adequately cleanable, and shall be properly maintained. The design, construction, and use of equipment and utensils shall preclude the adulteration of food with lubricants, fuel, metal fragments, contaminated water, or any other contaminants. All equipment should be so installed and maintained as to facilitate the cleaning of the equipment and of all adjacent spaces. Food-contact surfaces shall be corrosion-resistant when in contact with food. They shall be made of nontoxic materials and designed to withstand the environment of their intended use and the action of food, and, if applicable, cleaning compounds and sanitizing agents. Food-contact surfaces shall be maintained to protect food from being contaminated by any source, including unlawful indirect food additives.

(b) Seams on food-contact surfaces shall be smoothly bonded or maintained so as to minimize accumulation of food particles, dirt, and organic matter and thus minimize the opportunity for growth of microorganisms.

(c) Equipment that is in the manufacturing or food-handling area and that does not come into contact with food shall be so constructed that it can be kept in a clean condition.

(d) Holding, conveying, and manufacturing systems, including gravimetric, pneumatic, closed, and automated systems, shall be of a design and construction that enables them to be maintained in an appropriate sanitary condition.

(e) Each freezer and cold storage compartment used to store and hold food capable of supporting growth of microorganisms shall be fitted with an indicating thermometer, temperature-measuring device, or temperature-recording device so installed as to show the temperature accurately within the compartment, and should be fitted with an automatic control for regulating temperature or with an automatic alarm system to indicate a significant temperature change in a manual operation.

(f) Instruments and controls used for measuring, regulating, or recording temperatures, pH, acidity, water activity, or other conditions that control or prevent the growth of undesirable microorganisms in food shall be accurate and adequately maintained, and adequate in number for their designated uses.

(g) Compressed air or other gases mechanically introduced into food or used to clean food-contact surfaces or equipment shall be treated in such a way that food is not contaminated with unlawful indirect food additives.

Subpart D [Reserved]

Subpart E—Production and Process Controls

§ 110.80 Processes and controls.

All operations in the receiving, inspecting, transporting, segregating, preparing, manufacturing, packaging, and storing of food shall be conducted in accordance with adequate sanitation principles. Appropriate quality control operations shall be employed to ensure that food is suitable for human consumption and that food-packaging materials are safe and suitable. Overall sanitation of the plant shall be under the supervision of one or more competent individuals assigned responsibility for this function. All reasonable precautions shall be taken to ensure that production procedures do not contribute contamination from any source. Chemical, microbial, or extraneous-material testing procedures shall be used where necessary to identify sanitation failures or possible food contamination. All food that has become contaminated to the extent that it is adulterated within the meaning of the act shall be rejected, or if permissible, treated or processed to eliminate the contamination.

(a) *Raw materials and other ingredients.* (1) Raw materials and other ingredients shall be inspected and segregated or otherwise handled as necessary to ascertain that they are clean and suitable for processing into food and shall be stored under conditions that will protect against contamination and minimize deterioration. Raw materials shall be washed or cleaned as necessary to remove soil or other contamination. Water used for washing, rinsing, or conveying food shall be safe and of adequate sanitary quality. Water may be reused for washing, rinsing, or conveying food if it does not increase the level of contamination of the food. Containers and carriers of raw materials should be inspected on receipt to ensure that their condition has not contributed to the contamination or deterioration of food.

(2) Raw materials and other ingredients shall either not contain levels of microorganisms that may produce food poisoning or other disease in humans, or they shall be pasteurized or otherwise treated during manufacturing operations so that they no longer contain levels that would cause the product to be adulterated within the meaning of the act. Compliance with this requirement may be verified by any effective means, including purchasing raw materials and other ingredients under a supplier's guarantee or certification.

(3) Raw materials and other ingredients susceptible to contamination with aflatoxin or other natural toxins shall comply with current Food and Drug Administration regulations and action levels for poisonous or deleterious substances before these materials or ingredients are incorporated into finished food. Compliance with this requirement may be accomplished by purchasing raw materials and other ingredients under a supplier's guarantee or certification, or may be verified by analyzing these materials and ingredients for aflatoxins and other natural toxins.

(4) Raw materials, other ingredients, and rework susceptible to contamination with pests, undesirable microorganisms, or extraneous material shall comply with applicable Food and Drug Administration regulations and defect action levels for natural or unavoidable defects if a manufacturer wishes to use the materials in manufacturing food. Compliance with this requirement may be verified by any effective means, including purchasing the materials under a supplier's guarantee or certification, or examination of these materials for contamination.

(5) Raw materials, other ingredients, and rework shall be held in bulk, or in containers designed and constructed so as to protect against contamination and shall be held at such temperature and relative humidity and in such a manner as to prevent the food from becoming adulterated within the meaning of the act. Material scheduled for rework shall be identified as such.

(6) Frozen raw materials and other ingredients shall be kept frozen. If thawing is required prior to use, it shall be done in a manner that prevents the raw materials and other ingredients from becoming adulterated within the meaning of the act.

(7) Liquid or dry raw materials and other ingredients received and stored in bulk form shall be held in a manner that protects against contamination.

(b) *Manufacturing operations.* (1) Equipment and utensils and finished food containers shall be maintained in an acceptable condition through appropriate cleaning and sanitizing, as necessary. Insofar as necessary, equipment shall be taken apart for thorough cleaning.

(2) All food manufacturing, including packaging and storage, shall be conducted under such conditions and controls as are necessary to minimize the potential for the growth of microorganisms, or for the contamination of food. One way to comply with this requirement is careful monitoring of physical factors such as time, temperature, humidity, a_w, pH, pressure, flow rate, and manufacturing operations such as freezing, dehydration, heat processing, acidification, and refrigeration to ensure that mechanical breakdowns, time delays, temperature fluctuations, and other factors do not contribute to the decomposition or contamination of food.

(3) Food that can support the rapid growth of undesirable microorganisms, particularly those of public health significance, shall be held in a manner that prevents the food from becoming adulterated within the meaning of the act. Compliance with this requirement may be accomplished by any effective means, including:

(i) Maintaining refrigerated foods at 45 °F (7.2 °C) or below as appropriate for the particular food involved.

(ii) Maintaining frozen foods in a frozen state.

(iii) Maintaining hot foods at 140 °F (60 °C) or above.

(iv) Heat treating acid or acidified foods to destroy mesophilic microorganisms when those foods are to be held in hermetically sealed containers at ambient temperatures.

(4) Measures such as sterilizing, irradiating, pasteurizing, freezing, refrigerating, controlling pH or controlling a_w that are taken to destroy or prevent the growth of undesirable microorganisms, particularly those of public health significance, shall be adequate under the conditions of manufacture, handling, and distribution to prevent food from being adulterated within the meaning of the act.

(5) Work-in-process shall be handled in a manner that protects against contamination.

(6) Effective measures shall be taken to protect finished food from contamination by raw materials, other ingredients, or refuse. When raw materials,

other ingredients, or refuse are unprotected, they shall not be handled simultaneously in a receiving, loading, or shipping area if that handling could result in contaminated food. Food transported by conveyor shall be protected against contamination as necessary.

(7) Equipment, containers, and utensils used to convey, hold, or store raw materials, work-in-process, rework, or food shall be constructed, handled, and maintained during manufacturing or storage in a manner that protects against contamination.

(8) Effective measures shall be taken to protect against the inclusion of metal or other extraneous material in food. Compliance with this requirement may be accomplished by using sieves, traps, magnets, electronic metal detectors, or other suitable effective means.

(9) Food, raw materials, and other ingredients that are adulterated within the meaning of the act shall be disposed of in a manner that protects against the contamination of other food. If the adulterated food is capable of being reconditioned, it shall be reconditioned using a method that has been proven to be effective or it shall be reexamined and found not to be adulterated within the meaning of the act before being incorporated into other food.

(10) Mechanical manufacturing steps such as washing, peeling, trimming, cutting, sorting and inspecting, mashing, dewatering, cooling, shredding, extruding, drying, whipping, defatting, and forming shall be performed so as to protect food against contamination. Compliance with this requirement may be accomplished by providing adequate physical protection of food from contaminants that may drip, drain, or be drawn into the food. Protection may be provided by adequate cleaning and sanitizing of all food-contact surfaces, and by using time and temperature controls at and between each manufacturing step.

(11) Heat blanching, when required in the preparation of food, should be effected by heating the food to the required temperature, holding it at this temperature for the required time, and then either rapidly cooling the food or passing it to subsequent manufacturing without delay. Thermophilic growth and contamination in blanchers should be minimized by the use of adequate operating temperatures and by periodic cleaning. Where the blanched food is washed prior to filling, water used shall be safe and of adequate sanitary quality.

(12) Batters, breading, sauces, gravies, dressings, and other similar preparations shall be treated or maintained in such a manner that they are protected against contamination. Compliance with this requirement may be accomplished by any effective means, including one or more of the following:

(i) Using ingredients free of contamination.

(ii) Employing adequate heat processes where applicable.

(iii) Using adequate time and temperature controls.

(iv) Providing adequate physical protection of components from contaminants that may drip, drain, or be drawn into them.

(v) Cooling to an adequate temperature during manufacturing.

(vi) Disposing of batters at appropriate intervals to protect against the growth of microorganisms.

(13) Filling, assembling, packaging, and other operations shall be performed in such a way that the food is protected against contamination. Compliance with this requirement may be accomplished by any effective means, including:

(i) Use of a quality control operation in which the critical control points are identified and controlled during manufacturing.

(ii) Adequate cleaning and sanitizing of all food-contact surfaces and food containers.

(iii) Using materials for food containers and food- packaging materials that are safe and suitable, as defined in § 130.3(d) of this chapter.

(iv) Providing physical protection from contamination, particularly airborne contamination.

(v) Using sanitary handling procedures.

(14) Food such as, but not limited to, dry mixes, nuts, intermediate moisture food, and dehydrated food, that relies on the control of a_w for preventing the

growth of undesirable microorganisms shall be processed to and maintained at a safe moisture level. Compliance with this requirement may be accomplished by any effective means, including employment of one or more of the following practices:

(i) Monitoring the a_w of food.

(ii) Controlling the soluble solids-water ratio in finished food.

(iii) Protecting finished food from moisture pickup, by use of a moisture barrier or by other means, so that the a_w of the food does not increase to an unsafe level.

(15) Food such as, but not limited to, acid and acidified food, that relies principally on the control of pH for preventing the growth of undesirable microorganisms shall be monitored and maintained at a pH of 4.6 or below. Compliance with this requirement may be accomplished by any effective means, including employment of one or more of the following practices:

(i) Monitoring the pH of raw materials, food in process, and finished food.

(ii) Controlling the amount of acid or acidified food added to low-acid food.

(16) When ice is used in contact with food, it shall be made from water that is safe and of adequate sanitary quality, and shall be used only if it has been manufactured in accordance with current good manufacturing practice as outlined in this part.

(17) Food-manufacturing areas and equipment used for manufacturing human food should not be used to manufacture nonhuman food-grade animal feed or inedible products, unless there is no reasonable possibility for the contamination of the human food.

[51 FR 24475, June 19, 1986, as amended at 65 FR 56479, Sept. 19, 2000]

§ 110.93 Warehousing and distribution.

Storage and transportation of finished food shall be under conditions that will protect food against physical, chemical, and microbial contamination as well as against deterioration of the food and the container.

Subpart F [Reserved]

Subpart G—Defect Action Levels

§ 110.110 Natural or unavoidable defects in food for human use that present no health hazard.

(a) Some foods, even when produced under current good manufacturing practice, contain natural or unavoidable defects that at low levels are not hazardous to health. The Food and Drug Administration establishes maximum levels for these defects in foods produced under current good manufacturing practice and uses these levels in deciding whether to recommend regulatory action.

(b) Defect action levels are established for foods whenever it is necessary and feasible to do so. These levels are subject to change upon the development of new technology or the availability of new information.

(c) Compliance with defect action levels does not excuse violation of the requirement in section 402(a)(4) of the act that food not be prepared, packed, or held under unsanitary conditions or the requirements in this part that food manufacturers, distributors, and holders shall observe current good manufacturing practice. Evidence indicating that such a violation exists causes the food to be adulterated within the meaning of the act, even though the amounts of natural or unavoidable defects are lower than the currently established defect action levels. The manufacturer, distributor, and holder of food shall at all times utilize quality control operations that reduce natural or unavoidable defects to the lowest level currently feasible.

(d) The mixing of a food containing defects above the current defect action level with another lot of food is not permitted and renders the final food adulterated within the meaning of the act, regardless of the defect level of the final food.

(e) A compilation of the current defect action levels for natural or unavoidable defects in food for human use that present no health hazard may be obtained upon request from the Center for Food Safety and Applied Nutrition

(HFS–565), Food and Drug Administration, 5100 Paint Branch Pkwy., College Park, MD 20740.

[51 FR 24475, June 19, 1986, as amended at 61 FR 14480, Apr. 2, 1996; 66 FR 56035, Nov. 6, 2001]

PART 113—THERMALLY PROCESSED LOW-ACID FOODS PACKAGED IN HERMETICALLY SEALED CONTAINERS

Subpart A—General Provisions

Subpart B [Reserved]

Subpart C—Equipment

Subpart D—Control of Components, Food Product Containers, Closures, and In-Process Material

Subpart E—Production and Process Controls

Subpart F—Records and Reports

AUTHORITY: 21 U.S.C. 342, 371, 374; 42 U.S.C. 264.

SOURCE: 44 FR 16215, Mar. 16, 1979, unless otherwise noted.

Subpart A—General Provisions

§ 113.3 Definitions.

For the purposes of this part, the following definitions apply:

(a) *Aseptic processing and packaging* means the filling of a commercially sterilized cooled product into presterilized containers, followed by aseptic hermetical sealing, with a presterilized closure, in an atmosphere free of microorganisms.

(b) *Bleeders* means openings used to remove air that enters with steam from retorts and steam chambers and to promote circulation of steam in such retorts and steam chambers. Bleeders may serve as a means of removing condensate.

(c) *Come-up-time* means the time which elapses between the introduction of steam into the closed retort and the time when the retort reaches the required processing temperature.

(d) *Commercial processor* includes any person engaged in commercial, custom, or institutional (church, school, penal, or other organization) processing of food, including pet food. Persons engaged in the production of foods that are to be used in market or consumer tests are also included.

(e) *Commercial sterility:* (1) "Commercial sterility" of thermally processed food means the condition achieved—

(i) By the application of heat which renders the food free of—

(*a*) Microorganisms capable of reproducing in the food under normal nonrefrigerated conditions of storage and distribution; and

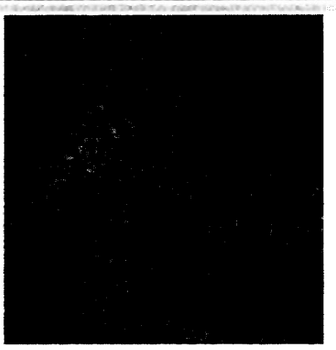
(*b*) Viable microorganisms (including spores) of public health significance; or

(ii) By the control of water activity and the application of heat, which renders the food free of microorganisms capable of reproducing in the food under normal nonrefrigerated conditions of storage and distribution.

(2) "Commercial sterility" of equipment and containers used for aseptic processing and packaging of food means the condition achieved by application of heat, chemical sterilant(s), or other appropriate treatment that renders the equipment and containers free of viable microorganisms having public health significance, as well as microorganisms of nonhealth significance, capable of reproducing in the food under normal nonrefrigerated conditions of storage and distribution.

(f) *Critical factor* means any property, characteristic, condition, aspect, or other parameter, variation of which may affect the scheduled process and the attainment of commercial sterility.

(g) *Flame sterilizer* means an apparatus in which hermetically sealed containers are agitated at atmospheric



Pellets

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Regular Hop Pellets

Form of Hop
Regular Hop Pellets (Type 90)

Description of Process
Hopsteiner Regular Hop Pellets are natural hops that are physically converted into a more convenient form.

The tightly compressed bales of hops are mechanically broken up and any foreign material is removed by physical and magnetic sorting. The hop cones are milled into powder which is then blended to insure consistency and uniformity of the hop pellets.

The mixed hop powder is then pelletized in a pellet mill. The pellets are packaged according to the customer's specifications in sealed foil pouches.

Stability
Hopsteiner Regular Hop Pellets preserve the brewing quality of hops. The foil barrier and the removal of oxygen in the hop pellet package greatly retard the degradations of alpha-acids and essential hop oils. Nevertheless, cold storage is recommended until the pellets are used in the brewery.

Utilization
30-40%
20 x 44lb. (20 Kg) Cartons

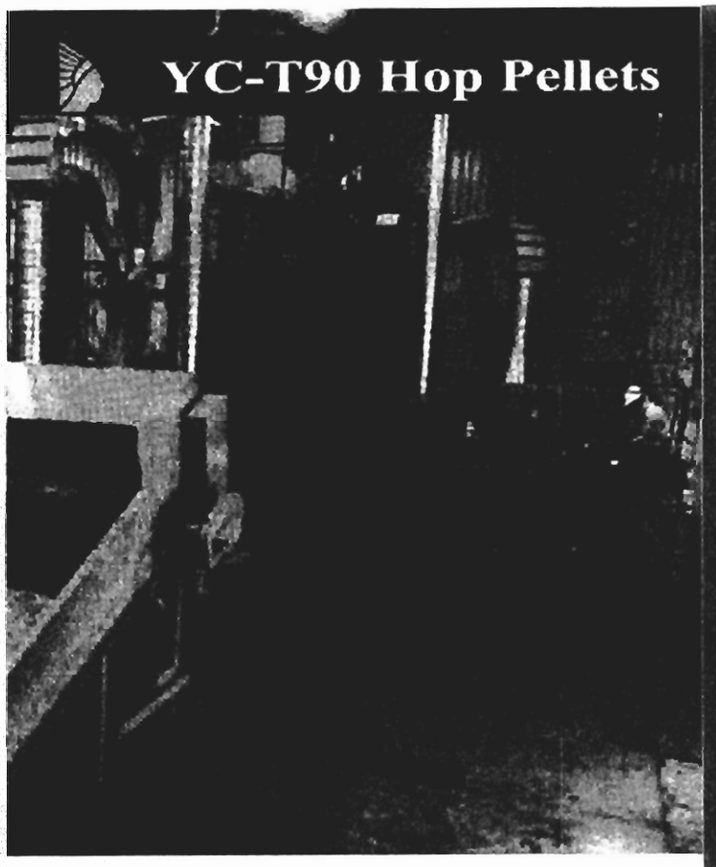
Advantages

- Uniformity of hop additions
- Savings in freight costs
- Reduced warehouse space
- Lower handling costs
- Less trub volume
- No hop separator
- Removal of foreign matter
- Preservation of brewing value
- Preservation of brewing aroma
- Retardation of oxidation

United States Germany PR China United Kingdom

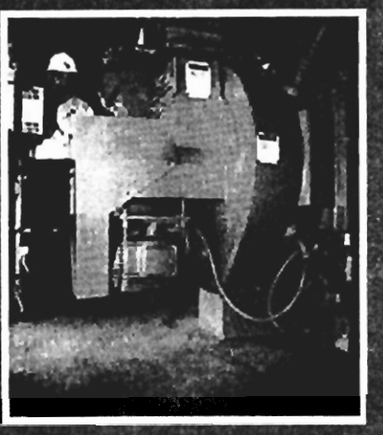
This site maintained by Devang Mehta

YC-T90 Hop Pellets



The Gamache Family

We're the Gamache family, one of the grower/owners who formed Yakima Chief, Inc. to market our hops direct to brewers worldwide at stable, competitive prices. Yakima Chief has control of our hop products from the bale to post-processing shipment - and offers consistent product quality, exceptional technical support, and total responsibility for our hops. Working with you to find the best solution for your brewing challenges - at Yakima Chief - that's business as usual!



YC-Type 90 Hop Pellets Continued

Specs | MSDS

YC-Leaf Hops | YC-T90 Hop Pellets | YC-CO_2 Hop Extract | YC-HopAroma | YC-HopAroma Super | YC-HopAroma Tabs | YC-AlphaRich | YC-IKE Plus | YC-KettleRho | YC-Iso | YC-Tetra | YC-Reduced Iso

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Home | About Yakima Chief, Inc. | Hop Products | Facilities/Capabilities | Craft Brewing Hop Varieties | What's New | Worldwide Offices & Staff | Partner Customers

Hop Pellets (Type 90 Pellets)

General:
Type 90 Pellets are a hop product added to the kettle to provide bitterness and hop character. They can also be used for dry hopping. They provide improved homogeneity, better storage stability and reduced storage/transport costs compared to raw hops. They produce a beer flavor which is not distinguishable from that produced from leaf hops. All hops are processed according to the ISO 9001:2000 standards and HACCP concept. Hop Pellets are generally recognized as safe (GRAS) by the U.S. FDA in accordance with regulation 21 CFR 182.20.

Product specifications[1]:

Description:	Cylindrical pellets of approx. 6mm (0.24 inch) diameter, milled and compressed whole hops
Consistency:	A solid which normally breaks up into a powder
Colour:	typically from dark-green to olive-green (depending on variety)
α-acids:	As in raw hops, depending on variety and crop year
β-acids:	As in raw hops, depending on variety and crop year
Hop oils:	As in raw hops, depending on variety and crop year
Moisture:	7-12%
Pesticides:	Meets current EU and US FDA regulations
Heavy Metals:	Meets current EU and US FDA regulations

Process specifications:

Drying temperature:	< 60°C, (140℉) depending on moisture content of raw hops
Pelletizing temperature:	< 55°C (130℉)
Temperature of pellets after cooling:	< 20°C (68℉)
Homogeneity:	± 5 % (relative) above tolerance of analysis

[1] Further information on varieties is also available on www.deutscher-hopfen.de and on http://www.hops.co.uk/sectionfour/Variety.htm

Product Use:
For efficient provision of bitterness, the pellets should be added to the wort at the beginning or up to 15 minutes after the start of the boil. Utilization of α-acids into beer depends on the boiling system and conditions and is normally in the range of 30%-35%. Added late into the boil, utilization of α-acids reduces but the utilization of the aroma increases. The quantity to be added is calculated using the α-acids content and the estimated utilization. The quantity to be added to obtain a characteristic aroma should be preferably calculated using the oil content of the product. Pellets can be dosed automatically.

Packaging:
Pellets are packed in laminated foils with an aluminium layer as a barrier against diffusion of oxygen. They are sealed under inert gas or vacuum packed. The foil material used meets all food industry packaging regulations regulations. The residual oxygen content in the foil packs is less than 2% by volume. Pack sizes are available from 2.5 kg to 140 kg.

Storage and shelf life:
Type 90 Pellets should be cool stored at 0-5° C (32-41 ℉). Pellets should be used within 3 years after processing. If stored at –20° C (-4℉), Pe llets should be used within 5 years. Foils, once opened, should be used within 24 hours to avoid deterioration of bitter acids and essential oils.

Specific analytical Methods:

The determination of α- acids comprises two types of methods, the specific measurement of α- acids by means of HPLC or conductometric methods:

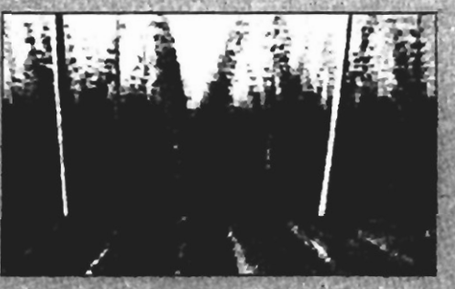
Concentration of α- acids:
α-acids can be measured by any of the following methods:
- EBC method 7.5 - (α-acids as lead conductometric value (LCV))
- ASBC Spectrophotometric method (Hops-6) -(α and β-acids)
- By HPLC, using the current ICE standard, according to the EBC 7.7 method, or the ASBC method (Hops-14) -(α and β-acids)

Concentration of Hop oils:
Hop oil concentration can be measured by:
- EBC 7.10
- ASBC hops-13

Safety:
If dust is generated, it is advisable to use a dust mask. Hop pellets are a combustible material. For further information please download the relevant Material Safety Data Sheet (MSDS).

Technical Support:
We will be pleased to offer help and advice on the use of Hop Pellets in brewing.

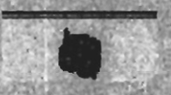
Establishing a Hop Yard



Building trellis and planting rootstock requires a significant investment. Trellis is suspended over the yard by approximately 135 poles per hectare (55 poles per acre) and connected by high quality wire and cabling that stands five to six meters (16-19.5 ft.) above the ground. Traditionally, the U.S. hop industry has used a 7-ft. x 7-ft. (approximately 2 x 2 m.) spacing, which resulted in 1778 strings per acre. There were two work rows every 14-ft. (3.5 m.). Growers typically cultivated a field in two directions with four tractor passes total, two in each direction. In the early 1980's growers began to change to a 3.5-ft. x 14-ft. (approximately 1 x 3 m.) spacing. Essentially, growers moved the middle row "out" to the pole row, in between the other plants. This resulted in one work row instead of two. By doing this, growers reduced their tractor work, and the associated expenses, by 75% because they only had to make one pass down the length of the field. Since the plants in the new layout were so close together, it was simply no longer possible to take the tractor across the rows. The number of strings per acre remained the same (1778 strings/acre).

As further encouragement to move toward wide spacing, traditional 7-ft. x 7-ft. spacing required the grower to "arch" the plants. "Arching" is simply the act of tying a string about waste high around the vines to keep them out of the way of the tractors. The labor involved with arching the vines cost about $15/acre ($37/hectare). Since the early 90's wide spacing has expanded rapidly together with drip irrigation. The most expensive part of establishing a drip irrigation yard is the tube. Since there are less work rows with wide spacing, it costs less to install the drip system. As of the year 2001, the majority of the industry has turned to wide spacing and drip irrigation is also becoming commonplace. In the quest for still greater efficiency, some growers are experimenting with alternative spacing techniques that would allow the number of passes through the field to remain the same while increasing the number of plants per acre.

Hops (humulus lupulus) are perennial plants whose rootstock will produce hops for many years. Some American hop varieties have still proven to be commercially viable after 50 years, but that is not the norm. In the never-ending quest for more efficient production and lower costs, the life of a commercial alpha hop variety has been drastically reduced. In the past, alpha hop varieties commonly produced for ten or more years before being replaced with quality rootstock of the same variety. Alpha hop varieties in the 21st century are removed and replaced with higher yielding varieties much more frequently than their predecessors. Aroma hop varieties however, are still replaced with quality rootstock approximately every ten years. These practices preserve optimum yields and enable the grower to be a more efficient producer.



Spring Activity

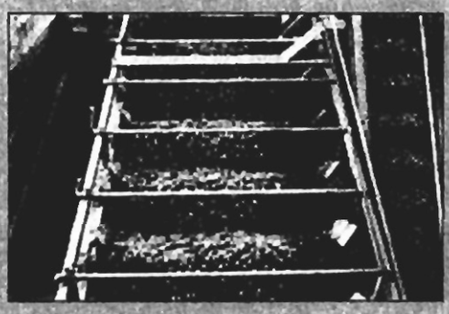
Every spring, soil samples are taken from each hop yard to determine the soil fertility. Samples are analyzed and specific fertilization programs are developed for every hop yard to balance nutrients and assure the highest quality and the best yields. In late March, pruning with tractor drawn mechanical pruners prepares the hop plants for proper training time. Old dry vines and debris are often removed from yards although some growers practice no-till agriculture. Also in the spring, twine is stretched from the overhead trellis network to the ground to provide support and direction for growing hop vines. During the month of May, one of the most labor-intensive parts of the hop growing process begins. Hop plants are trained to climb the twine supports. This entails field workers visiting each hop plant and wrapping several shoots around the twine support in a clockwise direction to begin their journey to the top of the trellis. To control excess shoot growth, leaves and shoots are often striped from the main vine. By late May or early June, as determined by weather conditions, irrigation of the hop fields begins. Rill, sprinkler, and the increasingly popular drip irrigation methods are all used to provide the water demands of the hop plant. During an average growing season, the hop field will require 50-75 cm. (20-30 in.) of water.

Regular cultivation provides weed control, and improves soil texture. Cultivation takes place in each hop row, four to six times in each direction during a typical growing season. The season's first cultivation takes place in early April, after the soil has dried from winter precipitation. Final cultivation usually takes place in late June or early July, as the fibrous root system of the plant begins to grow. To protect the roots, no additional cultivation takes place until after harvest. Producing hops is a very labor-intensive enterprise, requiring a skilled labor force that has traditionally been available. Approximately one laborer for every six to eight hectares (15-20 acres) is required in the spring months. At harvest time, the number of laborers doubles.

Harvest

Harvest begins by late August and can last just over a month depending upon the size of the farm and the varieties harvested. It is a very busy time when farm crews double in size and oftentimes work around the clock. Hop vines are first cut about one meter. (3-ft.) above the ground by an implement called a bottom cutter, which is attached to the front of a tractor. Within minutes the vines are cut from the overhead support wires by a machine called a top cutter. The hop-laden vines fall into truck beds or trailers, which transport them to picking machines located nearby. Typical picking machines can pick three to six hectares (7.5-15 acres) of hops per day, depending upon the variety and operating time. Hop vines enter the picking machine at the feeding station where vines enter upside down. Hops and leaves are stripped from the vines, which pass through the picking machine to the back of the system. Once there, they drop into a chopper and are turned into mulch, later to be returned to the soil. Leaves and hops fall through a traveling wire mesh and onto a conveyor which takes them through a series of cleaning devices that remove the leaves and stems from the hop cones. Stems and leaves eventually are conveyed to trash, while the hops are cleaned and recleaned by a network of screens, drums, and dribble belts. Once the hops are nearly free of stems and leaves, they fall onto a conveyor for a trip to the kiln.

Drying and Baling

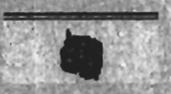


In the kilns, an automatic loader spreads clean hops across the kiln floor. A typical kiln floor is approximately 100 sq. m. (1056 square ft.), and will be evenly covered to a depth of a little less than one meter (approximately 1 yard). Traditionally hops rest on a floor that is covered by a loosely woven burlap cloth although some new kilns have metal floors with tiny holes through which hot air may pass. Oil and gas burners heat the air to a temperature of about 60¡-74¡Celsius (140¡-165¡ Fahrenheit). It is then forced through the bed of the freshly picked hops for about nine hours. During this time, the hop cone will lose up to 70% of its green weight and retain a moisture content of only 8-10%. Once dried, cool, moist air is forced through the dried hops while still on the kiln floor. Conveyors then move the hops to a cooling room where they are allowed to continue cooling for 12-24 hours. During this cooling period, moisture spreads evenly throughout the hop cones. After cooling, hops are conveyed to hydraulic balers that press the product into 200-pound (92-kilogram) bales. Bales measure 51x76x140 cm. (20x30x55 inches). Within 48 hours from the time the hops were harvested in the field, they are placed in cold storage warehouses. Hops undergo comprehensive quality inspection. Bale lots, consisting of 200 to 400 bales, are sampled and inspected by the United States Department of Agriculture (USDA). Core samples from each lot are sent to the USDA certification laboratory where the samples are analyzed for leaf, stem and seed content. Each lot is then issued a certificate documenting its percentage of leaf, stem and seed content. The certification is necessary before growers may sell their hops. So precise is quality control, that individual identity of each lot of hops can be traced to its original grower.

ESTABLISHING A HOP YARD
SPRING ACTIVITY
HARVEST
DRYING AND BALING
PLANT PROTECTION

Plant Protection

Hops are susceptible to a wide assortment of viruses and insects. Each year, cultural practices are refined to better control their spread. Since 1997, the American hop grower has had to deal with hop powdery mildew on several key varieties. The virus has cost the industry millions of dollars in lost production and even more in the fight to get it under control. While a solution to the problem of powdery mildew remains to be discovered, researchers are actively pursuing this goal through analysis of the disease itself and the development of powdery mildew resistant and tolerant varieties. The American hop growers are committed to development of a solution to the problem of hop powdery mildew, and they are working closely with private and university researchers to ensure the quality of every crop.



Hop Pellets (Type 90 Pellets)

General:
Type 90 Pellets are a hop product added to the kettle to provide bitterness and hop character. They can also be used for dry hopping. They provide improved homogeneity, better storage stability and reduced storage/transport costs compared to raw hops. They produce a beer flavor which is not distinguishable from that produced from leaf hops. All hops are processed according to the ISO 9001:2000 standards and HACCP concept. Hop Pellets are generally recognized as safe (GRAS) by the U.S. FDA in accordance with regulation 21 CFR 182.20.

Product specifications[1]:

Description:	Cylindrical pellets of approx. 6mm (0.24 inch) diameter, milled and compressed whole hops
Consistency:	A solid which normally breaks up into a powder
Colour:	typically from dark-green to olive-green (depending on variety)
α-acids:	As in raw hops, depending on variety and crop year
β-acids:	As in raw hops, depending on variety and crop year
Hop oils:	As in raw hops, depending on variety and crop year
Moisture:	7-12%
Pesticides:	Meets current EU and US FDA regulations
Heavy Metals:	Meets current EU and US FDA regulations

Process specifications:

Drying temperature:	< 60°C, (140℉) depending on moisture content of raw hops
Pelletizing temperature:	< 55°C (130℉)
Temperature of pellets after cooling:	< 20°C (68℉)
Homogeneity:	± 5 % (relative) above tolerance of analysis

[1] Further information on varieties is also available on www.deutscher-hopfen.de and on http://www.hops.co.uk/sectionfour/Variety.htm

Product Use:
For efficient provision of bitterness, the pellets should be added to the wort at the beginning or up to 15 minutes after the start of the boil. Utilization of α-acids into beer depends on the boiling system and conditions and is normally in the range of 30%-35%. Added late into the boil, utilization of α-acids reduces but the utilization of the aroma increases. The quantity to be added is calculated using the α-acids content and the estimated utilization. The quantity to be added to obtain a characteristic aroma should be preferably calculated using the oil content of the product. Pellets can be dosed automatically.

Packaging:
Pellets are packed in laminated foils with an aluminium layer as a barrier against diffusion of oxygen. They are sealed under inert gas or vacuum packed. The foil material used meets all food industry packaging regulations regulations. The residual oxygen content in the foil packs is less than 2% by volume. Pack sizes are available from 2.5 kg to 140 kg.

Storage and shelf life:
Type 90 Pellets should be cool stored at 0-5° C (32-41 ℉). Pellets should be used within 3 years after processing. If stored at –20° C (-4℉), Pe llets should be used within 5 years. Foils, once opened, should be used within 24 hours to avoid deterioration of bitter acids and essential oils.

Specific analytical Methods:

The determination of α- acids comprises two types of methods, the specific measurement of α- acids by means of HPLC or conductometric methods:

Concentration of α- acids:
α-acids can be measured by any of the following methods:
- EBC method 7.5 - (α-acids as lead conductometric value (LCV))
- ASBC Spectrophotometric method (Hops-6) -(α and β-acids)
- By HPLC, using the current ICE standard, according to the EBC 7.7 method, or the ASBC method (Hops-14) -(α and β-acids)

Concentration of Hop oils:
Hop oil concentration can be measured by:
- EBC 7.10
- ASBC hops-13

Safety:
If dust is generated, it is advisable to use a dust mask. Hop pellets are a combustible material. For further information please download the relevant Material Safety Data Sheet (MSDS).

Technical Support:
We will be pleased to offer help and advice on the use of Hop Pellets in brewing.

CO_2 Hop Extract

General:
CO_2 Hop Extracts have been prepared from natural hops or hop pellets using carbon dioxide and contain the α-acids, β-acids and essential oils of hops. The extract is processed according to the ISO 9001:2000 standards and a HACCP concept. It is classified by the U.S. FDA as a hop extract and are generally recognized as safe (GRAS) in accordance with Regulation 21 CFR 182.20.

Characteristics:
CO_2 Hop Extract retains the aroma and the bittering potential of the hops from which it is made. Stability is excellent. Compared to raw hops or hop pellets the extracts represent a convenient and concentrated alternative. Since the brewing characteristics of the original hops are maintained, an early addition to the kettle imparts mainly bitterness while late addition will result in a carry over of the volatile oils in beer with aromatic "late hop" character.

Product specifications:

Description:	Depending on the extraction conditions and the variety the colour of the extract can vary from yellow to dark green. It is a semi-fluid syrupal paste at room temperature. The product becomes more fluid when warmed up.
Viscosity:	approx. 1 – 3 Pas at 30 – 40 °C (86 – 104 °F), (depending on variety).
α-acids:	Range for aroma hops approx. 35% and >50% for high alpha hops (depending on variety)
β-acids:	15 - 40% (depending on variety)
Hop oils:	3 – 12 ml/100 g (depending on variety)
Density:	0.9 – 1.0 g/ml
Pesticides:	Meets current EU and US FDA regulations
Heavy Metals:	Meets current EU and US FDA regulations

Process specifications for supercritical CO_2 Hop Extract :

Carbon Dioxide Quality:	food grade CO_2
Extraction temperature:	50 – 60 °C (122 – 140°F)
Extraction pressure:	150 – 300 bar

Process specifications for subcritical (liquid) CO_2 Hop Extract :

Carbon Dioxide Quality:	food grade CO_2
Extraction temperature:	5 – 15 °C (41 – 60°F)
Extraction pressure:	55 – 70 bar

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Feb. 2006

Product Use:
For efficient provision of bitterness, the extract should be added to the kettle at the beginning or up to 10 minutes after the beginning of the wort boil. Utilisation of α-acids in beer is slightly better compared to non-isomerized pellets and within the range of 32%-38%. Added late in the boil utilisation of α-acids may be reduced considerably. The quantity to be added is calculated using the α-acids content and the estimated utilisation. Actual utilisation may vary depending on plant and processing parameters. If added by means of an automatic dosing system, the extract should be warmed up to 40 ℃ and gently agitated to ensure proper dosing.

Packaging:
Standardisation of the alpha acid content can be achieved by adjusting the weight of extract in each container. Alternatively, the alpha acid content of the extract can be standardised by the addition of a glucose syrup or some other food grade material. Container sizes range from 0.5 to 4 kg. Non-returnable bulk containers are available in sizes ranging from 50 to 200 kg. Containers meet all food industry packaging regulations. When bulk containers are supplied for automatic dosing units, viscosity analysis maybe provided on request. All internal surfaces of containers are lined with a food grade coating.

Storage and shelf life:
CO_2 Hop Extract is exceptionally stable when properly stored. Hop oils are preserved in the condition as they were in hops. CO_2 Hop Extract should be cold stored at 0-5℃ (32-41℉) and should be used within 8 years after processing. If stored at ambient conditions (below 25℃, 77℉) extracts should be used wi thin 3 years. Containers once opened should be used within a few days.

Analytical Methods:

The determination of α- acids comprises two types of methods, the specific measurement of α- acids by means of HPLC and conductometric methods

Concentration of α- and β-acids:
The concentrations of these hop resin acids are measured by:

- HPLC, using the current ICE standard, according to the EBC 7.7 or the ASBC Hops-14 methods.
- Conductometric methods – EBC 7.6, or ASBC Hops-8 and spectrophotometric method ASBC Hops-6 can also be used.

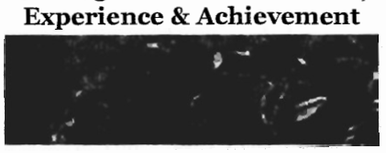
Concentration of Hop oils:
Hop oil concentration can be determined by EBC 7.10 and ASBC Hops-13.

Safety:
CO_2 Hop Extract is a natural, non-toxic substance and may be safely handled using routine precautions to avoid contact with skin and, particularly, eyes. For more information please download the relevant Material Safety Data Sheet (MSDS).

Technical Support:
We will be pleased to offer help and advice on the use of CO_2 Hop Extract in brewing.

Company Profile

Over 150 Years of Tradition, Experience & Achievement



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Our company, which started in 1845 as a small hops dealership, is today one of the largest international hop growing, trading and processing firms. The success of the Steiner group is largely due to our continuity as a family-owned and run business, and to the hard work and innovation of present and past management and employees.

Pictured:
Louis S. Gimbel 4th,
L.S (Tom) Gimbel ,
Adam M. Gimbel

Martin E. Ungewitter, Louis S. Gimbel 4th, L.S (Tom) Gimbel, Adam M. Gimbel, Philip Wolfman

In over 155 years of activity the efforts of our management and employees have endowed us with a depth of tradition, experience and achievement that gives our customers the knowledge that Steiner will be there for them and all of their hops-related needs.

The Hopsteiner Team at Drinctec Trade Fair, Germany

United States Germany PR China United Kingdom

This site maintained by Devang Mehta

Pellets

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Regular Hop Pellets

Form of Hop
Regular Hop Pellets (Type 90)

Description of Process
Hopsteiner Regular Hop Pellets are natural hops that are physically converted into a more convenient form.

The tightly compressed bales of hops are mechanically broken up and any foreign material is removed by physical and magnetic sorting. The hop cones are milled into powder which is then blended to insure consistency and uniformity of the hop pellets.

The mixed hop powder is then pelletized in a pellet mill. The pellets are packaged according to the customer's specifications in sealed foil pouches.

Stability
Hopsteiner Regular Hop Pellets preserve the brewing quality of hops. The foil barrier and the removal of oxygen in the hop pellet package greatly retard the degradations of alpha-acids and essential hop oils. Nevertheless, cold storage is recommended until the pellets are used in the brewery.

Utilization
30-40%
20 x 44lb. (20 Kg) Cartons

Advantages

- Uniformity of hop additions
- Savings in freight costs
- Reduced warehouse space
- Lower handling costs
- Less trub volume
- No hop separator
- Removal of foreign matter
- Preservation of brewing value
- Preservation of brewing aroma
- Retardation of oxidation

United States Germany PR China United Kingdom

This site maintained by Devang Mehta

<!-- function MM_preloadImages() { //v3.0 var d=document; if(d.images){ if(!
d.MM_p) d.MM_p=new Array();
i,j=d.MM_p.length,a=MM_preloadImages.arguments; for(i=0; i<a.length; i++)
if (a[i].indexOf("#")!=0){ d.MM_p[j]=new Image; d.MM_p[j++].src=a[i];}}
(i=0;a&&i<a.length&&(x=a[i])&&x.oSrc;i++) x.src=x.oSrc; } function
MM_swapImage() { //v3.0 var i,j=0,x,a=MM_swapImage.arguments;
document.MM_sr=new Array; for(i=0;i<(a.length-2);i+=3) if ((x=
(a[i]))!=null){document.MM_sr[j++]=x; if(!x.oSrc) x.oSrc=x.src; x.src=a
[i+2];} } //-->

CO2 Extract

- Bitterness
- Aroma
- Storage Stability
- Improved Beer Quality

Hopsteiner CO2 Extract is produced by natural carbon dioxide extraction of hops. All the essential hop constituents (alpha-acids, beta-acids, and hop oils) are captured and preserved in this extremely pure and consistent CO2 hop extract.

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Undesirable hop constituents such as hard resins, deteriorated resins, tannins, polyphenols, nitrates, hop protection chemicals, fats and waxes are reduced. Hopsteiner CO2 hop extract will produce a beer similar to or better than traditional hopping methods.

Hopsteiner CO2 Extract is produced by state of the art carbon dioxide extraction technology and is produced as a supercritical CO2 hop extract. Carbon dioxide is a natural solvent, eliminating the concern of residual solvent that is always present when using hop extract produced with hexane or methylene chloride solvents.

Hopsteiner CO2 Extract provides the same type of bitterness that is acquired from traditional hopping. Since nearly all the original hop's alpha-acids are in Hopsteiner CO2 Extract, the same varietal bitterness profile is maintained.

Hopsteiner CO2 Extract duplicates the hop aroma of traditional hopping. Since nearly all the essential hop oils remain in Hopsteiner CO2 Extract, the same varietal aroma profile is maintained.

Hopsteiner CO2 Extract is an extremely stable hop extract and is therefore the best long term method to

preserve hop alpha-acids and essential oils. When stored in sealed containers at cool temperatures, Hopsteiner@ Co2 Extract will maintain its integrity for years. Recommended storage temperatures are 10OF(-120C) minimum and 771F (250C) maximum. The reduced size and improved storability compared to baled hops lowers costs associated with handling, storage, shipping and alpha loss.

EXTRACT

Ethanol Pure Resin Extract

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Consistency:	Viscous
Color:	Dark Green
Chemical Characteristics:	Chemical Whole hops are extracted by fermentation alcohol. The resulting Characterization: non polar product consists of approx. 90% hop bitter acids (alpha- and beta-acids and unspecified soft and hard resins) and of 5 - 8% hop oils (mainly myrcene, & caryophyllene, a humulene). Remaining components are other non polar hop ingredients and water. The residual ethanol content is below 0,5%.
Physical Properties:	Bulk density approx. 1.0 kg/dm3
Viscosity:	Approximately 10.000 mPas at 30 degrees C and approximately 1.000 mPas at 50 degrees C
Solubility:	Note easily dissoluble in pure water (< 1g/l at 50C)
Packaging:	Metal Drums (200kg) or in tins (0.5 - 10kg)
Other:	The product is classified as food according to § 1 of the German Food Regulation. According to the German Beer Law the product is usable for brewing beer.

Domestic Varieties

Varieties available through Hopunion CBS are marked as follows:

RH=Raw Hop
HP= Hop Pellets
HO= Hop Oil

Cascade

Crystal
US Golding

Fuggle
Hallertau
Liberty
Mt Hood
Tettnang
US Saaz
Ultra
Willamette

Bullion
Centennial
Chinook
Columbus
Northern
Brewer
Galena
Nugget
US Perle
Horizon
Santiam
Cluster
Magnum
Amarillo
Sterling

Interpretive Gu
to the Hopuli
Variety Data Sh

The following notes are meant to help readers get the most out of the information contained in the data sheets. The following items describe the properties of hops:

- Yield
- Growth Habit
- Disease Reaction
- Pickability
- Drying/Baling
- Cone Structure
- Quality Characteristics
  - Lupiin
  - Aroma
  - Alpha Acids
  - Beta Acids
  - Co-Humulone
  - Storageability
  - Total Oil
  - Mycrene, Humulene, Caryophyllene and Farnescene
- General Trade Perception
- Possible Substitutions
- Beer Styles
- OTHER INFORMATION

Pedigree

Import Varieties

Same indicators apply as with domestic for availibity

CZ Saaz

UK Bramoling Cross
Kent Golding

UK Fuggle

UK WyG
FR Strisselspalt
GR Hersbrucker
GR Hallertau

GR Tradition

GR Spalt
GR Select
GR Tettnang

Polish Lublin
Styrian Golding

Pride of Ringwood
UK Progress

UK Challenger

GR Perle
GR Norther Brewer
UK Northdown

UK Tradition
NZ Hallertau
GR Brewer's Gold
UK Admiral
UK First Gold
UK Pioneer
UK Phoenix
UK Target
GR Magnum

Characteristics Page (left)