

Beer Recipe Design



Recipe Approaches

	Less Advanced <-----> More Advanced			
Approaches	Brew Recipes "as is" from books like <i>Brewing Classic Styles</i> or NHC award winners from the AHA web site. (But beware of <i>random</i> online recipes.)	Tweak Existing Recipes (ingredient amounts, process times /temperatures) to fix problems or enhance to personal tastes.	Build Recipes from Scratch, using knowledge of the style (or guidelines) and Traditional Ingredients/ Processes for the style/region	Build "outside the box," using any ingredients/processes that serve the intended beer characteristics, whether aimed at a particular style or not
Simple Examples	Tasty McDole's "Janet's Brown Ale" as is	Replace half of the Janet's Brown Ale recipe's Chocolate Malt with Pale Chocolate Malt, for added cocoa-like complexity. Maybe add a tiny amount of Roasted Barley to restore lost color.	Start with an American Base Malt (2-Row), select a mid-range American Caramel Malt for flavor, and Chocolate Malt(s) for color, roast, and cocoa flavor. Cascade Hops to 40-ish IBUs and Chico Yeast...it's an <i>American Brown Ale</i> .	Replace 2-Row with Maris Otter or Golden Promise for nuttiness. (Or add a little Biscuit Malt.) Maybe use British Crystal and Chocolate Malts for complexity. Stick with Cascade (or other American) Hops in fairly large amounts and late, to distinguish it from English brown ales. Consider a higher mash temp and/or an English Yeast strain to leave a little more residual sweetness, if it serves the intent.



Recipe Design Basic Factors

- Ingredients
- Process



Recipe Design - Ingredients

- Malts and Adjuncts
- Hops
- Yeast
- Water
 - covered in Intro to Water Brewing Treatment
 - <http://sonsofalchemy.org/wp-content/uploads/2019/01/Intro-to-Brewing-Water-Treatment.pdf>



Malts and Adjuncts

- **Malts:** Grains (Barley or Other) that have been (at a minimum) steeped, germinated, and dried
 - most have also have been through some combination of kilning (beyond that needed to dry), roasting, and/or stewing
- **Adjuncts:** Non-Malted sources of Carbohydrates



Malt Categories

- **Base Malts:** Malts that have been relatively lightly kilned, preserving their diastatic power (enzymes) for mashing.
- **Toasted Malts:** Malts that have been relatively higher kilned (higher temps and or times), or lightly roasted, destroying much (or all) of their diastatic power.
- **Crystal/Caramel Malts:** Malts that have been Stewed, converting most of their starches to sugars (largely caramelized) and other dextrins. Sometimes roasted.
- **Dark Roasted Malts:** Malts that have been roasted (often in drum roasters) for color and roasty flavors.



Malt Category Examples

Base Malts	Pilsner, 2-Row Brewers, Pale Ale, Vienna, Munich, Pale Wheat Malt, Malted Oats, Rye Malt, Malted Corn
Toasted Malts	Victory, Biscuit, Honey, Brumalt, Melanoidin, Aromatic, Amber, Brown,
Caramel / Crystal Malts	Carapils, Carafoam, Carahell, Caravienne, Caramunich, Caraaroma, Briess Caramels, English Crystals, Special B, Golden Naked Oats
Dark Roasted Malts	Chocolate, Coffee, Black Patent, Carafa/Carafa Special



Base Malts

- “Backbone” of the grain bill
- Provide the enzymes needed in the mash, and the bulk of the starches to be converted to sugars and unfermentable dextrins
- Their contributions to worts are more fermentable than other malt categories’ contributions.
 - see Attenuation Factors Presentation
 - <http://sonsofalchemy.org/wp-content/uploads/2019/05/Attenuation-Factors.pdf>
- Usually lighter in color than other categories
- Used in higher proportions than other categories - typically 70-100%



Base Malts – Characteristics (subjective)

Lighter & more fermentable

Darker & less fermentable

- **Pilsner**: mild, sweet, honey notes, hay, cracker
- **2-Row Brewers**: neutral
- **Pale Ale** (e.g. Golden Promise, Maris Otter): sweet, rich, nutty, bready
- **Vienna**: sweet, honey, nutty
- **Munich**: honey, bready, subtle caramel, toasty
- **(Pale) Wheat Malt**: bready, biscuit. Improves foam.
- **Malted Oats**: nutty. Silky mouthfeel. Bad for foam.
- **Rye Malt**: grainy, earthy. Improves foam. Dry mouthfeel.
- **Malted Corn**: earthy, sweet, vegetal



Toasted Malts

- Specialty “accent” malts – typically 0-15%
- Few or No Enzymes
 - starches in these malts must be converted by enzymes from base malts.
- Their contributions to worts are somewhat less fermentable than base malts’ contributions.
- Darker than base malts. Typically 20-30 Lovibond (~60 Lov for Brown Malt)
- Used to enhance honey, toasty, and/or strong malty flavors that come from Maillard (“browning”) reactions.
- Also used for Color



Toasted Malts – Characteristics (subjective)

- **Melanoidin/Aromatic:** biscuit, nutty, toasted bread, strong malty aroma
- **Honey/Brumalt:** honey, toast, bread crust, pretzel
- **Victory/Biscuit/Amber:** biscuit, toasted bread, nutty
- **Brown:** toasty, nutty, bitter, chocolate



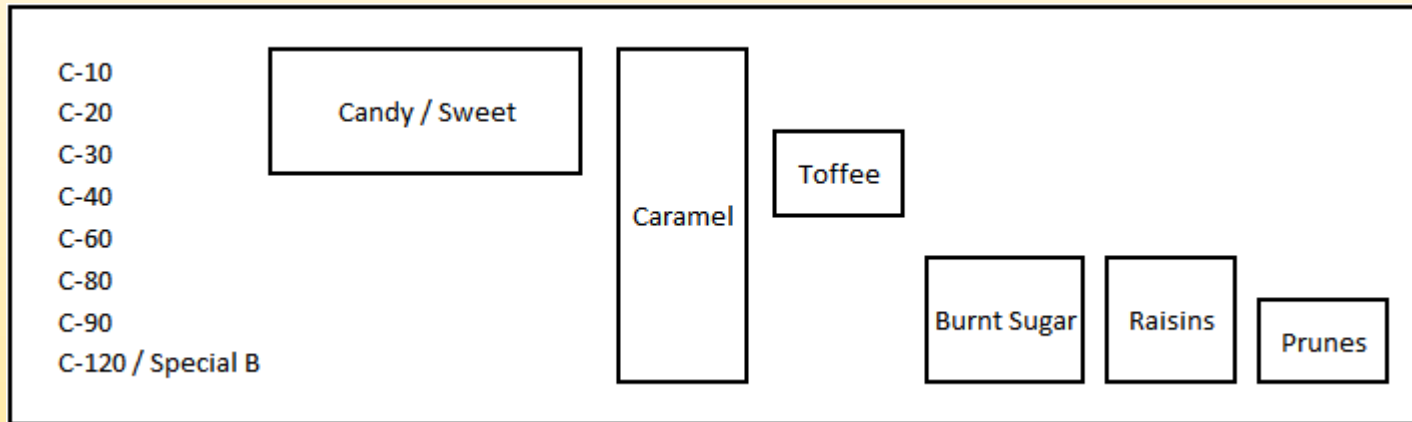
Caramel/Crystal Malts (aka C-Malts)

- Specialty malts – typically used at 0-15%
- No Enzymes... but very little starch due to pre-conversion
 - Can be *steeped* without a base malt
- Their contributions to worts are much less fermentable than base malts' contributions.
- Used for...
 - Color
 - Caramelly/Sweet/Dark Fruit Flavors
 - Body/Foam (especially Carapils/Carafoam/Carahell, i.e. Dextrin Malts)

} “Color” C-Malts



Color C-Malt Flavors



Representative examples. There are also many “in between” colors, particularly from British Maltsters.

Listed flavors tend to be more intense in darker vs. lighter colors.



Dark Roasted Malts

- Specialty malts – typically used at 0-15%
- No Enzymes... but very little starch due to high temperature roasting
 - Can be *steeped* without a base malt
- Contributions to worts are *much* less fermentable than base malts' contributions
- Much Darker (130-625 Lovibond) than base malts
- Used for...
 - Color
 - Roasty Flavors
 - Foam



Dark Roasted Malts – Characteristics (subjective)

- **Coffee** (130-170 Lov): Coffee Flavors, Moderately Roasty
- **Pale Chocolate** (~220 Lov): Coffee, Cocoa. Moderately Roasty
- **Chocolate** (350-475 Lov): Coffee, Cocoa, Burnt Roasty
- **Carafa I, II, III** (340, 431, 525 Lov): Roasty
- **Carafa Special I, II, III** (340, 431, 525 Lov):
“Debittered” ...Dehusked and Less Roasty than regular Carafa
- **Black Patent** (500-625 Lov): Very Roasty, Bitter, Subtle Currant/Blackberry



Adjuncts

- Unmalted Grains and Other Sources of Carbohydrates
- No Enzymes... starches from Adjunct Grains must be converted by enzymes from base malts, so are *Not* Steepable.
- Includes Raw/Processed Sugars, Honey, etc.
- Used (depending on adjunct) for...
 - More Body
 - Less Body
 - Various Flavors and Other Characteristics
 - Cheap Alcohol Production



Adjunct Grains – Characteristics

- **Barley:** increase body and foam retention, haze, grainy flavor, lighter color (or darker in the case of Roasted Barley)
- **Corn:** decrease body/haze/foam, slightly sweet
- **Rice:** decrease body/haze/foam, lighter color
- **Wheat:** increase foam retention, haze
- **Oats:** silky mouthfeel, decrease foam, increase haze
- **Rye:** earthy flavor, increase foam, dry mouthfeel
- **Spelt:** slight nutty flavor

Most are available in both “raw” (unprocessed) and flaked forms. Raw grains benefit from a cereal mash, which gelatinizes the starches, making them available to the main mash.



Some Non-Grain Adjuncts

- **Table Sugar (Sucrose):** 100% Fermentable. Neutral Flavor. Boosts ABV without adding body
- **Corn Sugar (Dextrose):** Nearly 100% Fermentable (some water content). Metabolically easier for yeast to use than table sugar.
- **Brown Sugar/Piloncillo:** Caramel/Toffee flavor. Less fermentable.
- **Molasses/Black Treacle:** Smokey/Bitter. Less fermentable.
- **British Invert Syrups/Belgian Candi Syrups:** Various colors. Flavor ranges similar to Caramel Malts. Darker colors less fermentable.
- **Lactose (Milk Sugar):** Not fermentable by ale/lager yeast strains. Adds body and sweetness. About 20% as sweet as (unfermented) table sugar.



Hops – Some Major Groupings and General Characteristics

- **Nobles/Quasi-Nobles:** Grown in Germany and Czech Republic
- **English**
- **American:** Typically from the Pacific Northwest
- **Southern Hemisphere:** Australia and New Zealand

Herbal/Spicy characteristics relatively survivable, even used early in the boil

Fruity/Floral characteristics relatively volatile, better for late additions and dry hopping

Hops (dry hops) provide most of the Haze in New England IPAs.



Hops – Some Popular Examples

<u>Hop</u>	<u>Characteristics</u>	<u>Common Use</u>
Amarillo	Citrus, Orange, Floral	IPAs, Wheat Beers
Cascade	Floral, Spicy, Citrus, Grapefruit	West Coast IPAs, American Ales
Centennial	Floral, Citrus	West Coast IPAs, Wheat Beers
Challenger	Pine, Fruity, Grassy, Spicy	English Ales, American Ales
Citra	Citrus	IPAs, Wheat Beers
Columbus	Orange, Grapefruit, Earthy, Spicy	West Coast IPAs
East Kent Goldings	Herbal, Floral, Grassy, Orange Peel	English Ales, Belgian Ales
Galaxy	Passion Fruit, Citrus	NEIPAs
Hallertau Mittelfrüh	Herbal, Earthy, Hay, Spicy, Floral	Lagers, Belgian Ales, Hefes
Idaho 7	Tangerine, Herbal	NEIPAs
Magnum	Neutral, slightly Fruity	Bittering
Mosaic	Citrus, Pine, Blueberry, Peach, Tropical	IPAs
Motueka	Tropical, Citrus	NEIPAs
Riwaka	Kumquat, Grapefruit	Pilsner, IPA, Saison
Saaz	Spicy, Earthy	Lagers
Sabro	Tangerine, Coconut, Tropical, Stone Fruit	IPAs, Wheat Beers
Simcoe	Pine, Passion Fruit, Berry, Bubblegum, Citrus	West Coast IPAs
Strata	Strawberry, Passion Fruit, Grapefruit	IPAs
Vic Secret	Pineapple, Pine, Passionfruit	NEIPAs



Yeast – Some Major Strain Groupings and General Characteristics

- **American:** generally the cleanest, most neutral ale strains
- **English:** usually more fruity (esters), less attenuative, and faster flocculation than American strains. Some more prone to diacetyl production.
- **Belgian:** often highly phenolic/spicy and fruity. Some tolerant of high fermentation temperatures.
- **Hefeweizen:** Clove and Banana
- **Lager:** cleanest strains, especially when fermented cold. Some more prone to diacetyl production.
- **Kveik:** Tolerant of very high fermentation temperatures. Some cleaner than others. Just Say No to Kveik “Lagers.”



Process Considerations Related to Recipe Design

- **Mash Time:** Longer Mash Times yield more fermentable worts.
- **Mash Temperatures:** Temps at/below 151F yield more fermentable worts. Above 151, the higher the Temp, the Lower the fermentability. And Step Mashes can yield the most fermentable worts.
- **pH**
 - Higher Mash/Boil pH yields darker color
 - Higher Mash pH yields more mouthfeel
 - Hops increase beer pH.
 - Lower beer pH accentuates hop flavors
- **Boil Time:** Longer boils *may* be appropriate for recipes with large amounts of Pilsner Malts, to avoid noticeable DMS in beer.



Recipe Tweaks/Troubleshooting

<u>Beer is/has...</u>	<u>Try...</u>
Too Sweet	Mash Longer and/or at Lower Temp. Cut back on Caramel/Crystal Malts. Use a More Attenuative Yeast Strain
Too Dry	Mash Shorter and/or at Higher Temp. Add Caramel/Crystal Malts. Use a Less Attenuative Yeast Strain. Add Lactose.
Too Dark	Make sure mash pH is not too high. Reduce Caramel/Crystal, Toasted, Roasted Malts
Too hazy	Reduce Flaked Barley/Wheat/Oats. Cold Crash/Condition and/or use Gelatin.
Not hazy enough	Add Flaked Barley/Wheat/Oats. Increase Dry Hops
Bad Foam Retention	Add Wheat or Rye. Reduce Oats. Add Dextrin Malt. Add Roasted Malts
Lack of Malt Character	Replace 2-Row Malt with another Base Malt. Add Vienna, Munich, or Toasted Malts
Poor Mouthfeel	Mash at Higher Temp. Add Malted Oats
Too Much Body	Replace some Base Malt with Flaked Corn or Rice, or Sugar.
Too Roasty	Reduce Dark Roasted Malts or Roasted Barley, or replace with Carafo Special
Not Chocolatey Enough	Mix Brown Malt, Pale Chocolate and Chocolate Malts. Add a hint of Vanilla.
Not Enough Fruity Esters	Use an English Yeast Strain. Ferment at Higher Temperature.
Too Many Esters	Use an American Yeast Strain. Ferment at Lower Temperatures.
Objectionable Buttery Flavor	Longer Fermentation. Diacetyl Rest. Use a Yeast Strain less prone to Diacetyl.
Green Apple Flavor	Longer Fermentation.
IPA Tastes Dull	Add Citric Acid after fermentation
Cooked Corn/Vegetal Flavor	Longer Boil Time.

