Malt Flavour Creation and Sensory Evaluation

A century of heritage pushing us forward
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About me

• BSc Applied Molecular Sciences / MAGB Malting Diploma
• 13 years global malting experience
  • Canada Malting, Bairds, Great Western Malting
• Avid homebrewer
  • Gallon SS Brewtech Mash and Kettle
Agenda
Overview of Topics to Cover

Malt Flavour Creation

Sensory Methodologies
(Old Tactics)

Hot Steep Analysis
(New Wave Tactics)
Malt Flavour Creation

Flavour in Malt

Hierarchy of Malt Flavour Contributors

Steeping / Germination/Kilning

Maillard Reaction

Off Flavours in Malt
Malt Flavour Creation

Malt is the “Soul” of Beer

- Source of extract, hence alcohol
- Mash Enzymes – Alpha, Beta Amylase, Limit Dextrinase, α-glucosidase
- Source of Yeast nutrients and in particular FAN
- Excellent buffer of pH in Wort
- Milled husk materials act as a filter bed during mash filtration (Lautertun & mash tun)
- A source of foam stabilizing proteins
- Source of polyphenols \(\Rightarrow\) antioxidant power

- FLAVOUR \(\Rightarrow\) Focal point today
  - Maltings impact on flavour
    - Control of key parameters
  - SENSORY
Malt Flavour Creation

Hierarchy of Malt Flavour Contributors

Malt House Character

Terroir (Growing Region)

Variety of Barley

Greatest impact ?? .. So what is malting and how do we control flavor?
Malt Flavour Creation

Overview of Malting

1. STEEPING
   The seed is soaked in water to start it growing

2. GERMINATION
   The barley grows under controlled conditions and the ‘modification’ occurs inside the seed

3. KILNING
   The malt is dried out and the color and flavor are developed
Malt Flavour Creation
Steeping – Control / Contribution to Flavour

Steeping “sets the stage” for the type of malt being made:

- Each type of malt has a specific recipe structure that effects the flavour of the finished product
- Flavour (Taste, Mouthfeel, Aroma) linked to degree of modification of malt

- Pilsener – Target 42-44% cast moisture
- 2 Row – Target 44-46% cast moisture
- Pale Ale – Target 45-47% cast moisture

- Vienna → Melanoidin – 47% + cast moisture
  - Degree of modification
Malt Flavour Creation

Germination – Control / Contribution to Flavour

Germination – Enzymes synthesized and “passive transport” pathways utilized

Modification of malt directly impacts:

- Simple sugar content – Drives Maillard reaction
- Solubilized protein and Free amino nitrogen – Drives Maillard reaction and provides nutrients for yeast propagation
- Cell Wall Breakdown – Beta Glucan and other large molecular weight structures breakdown that impacts mouthfeel
- Dextrin Malts (Cara Pils / Dextra Pils) – BG ppm??
- Germination also sets moisture content for kilning
Malt Flavour Creation

Kilning plays the key role in developing flavour in malt

Kilning – **Stopping** the modification process, creating stability for storage and utilizing molecules created during malting to “**produce flavour and aroma**”

How do maltsters change the flavour profile in malt??
- Changes in temperature during drying and curing
- Adjustments to airflow
- Introduction of steam into the kiln bed
- Additional processing through Roasting

**STEPPING / GERMINATION AND KILING EFFECT THE MAILLARD REACTION**
Malt Flavour Creation

The Maillard Reaction

- Carbonyl group of the reducing sugars interact with amino acids prior to higher molecular weight formation
- Melanoidin compounds formed are important for colour and flavour
- Degradation lower MW compounds are important to flavour
- Reductones important for beer stability

Flavors such as malty, bready, biscuit, nutty, cracker as well as aromas contributed by pyrazine through the Maillard reaction in kilning
Malt Flavour Creation

Off Flavours in malt created in process

- DMSP
  - Cooked vegetable / Creamed Corn
- Lipoxygenase
  - Oxidation / Cardboard / Wet Paper
- Moldy / Mildew
  - Earthy / Soil like character
- Husky / Grainy
  - Straw / Hay like character

SO... How do you avoid these flavours in beer?
Quality Malt / Sensory / Brewing Practices
Malt Flavour Creation

Summary

• Malt flavour influenced during all stages in the malting process
  • Steeping / Germination / Kilning / Roasting / Steam

• Quality Control
  • Batch to batch consistency translates to consistency in beer
  • Quality Assurance at malthouse ensures quality flavour and no off flavours

• QUALITY MALT gives the opportunity to create QUALITY BEER
Malt Sensory Methods

Overview
Visual / Chew
Congress Mash - Craft
# Malt Sensory Methods

## Overview

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<th>Chew</th>
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<th>Congress Mash</th>
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<td>Basic</td>
<td>Basic</td>
<td>Intermediate</td>
<td>Difficult</td>
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Value in all tests, but best interpretation / translation to beer flavour found in Hot Steep Methodology.
Malt Sensory Methods

Visual Analysis

Visual (Easy)

- Color
- Plump / Thin
- Damage / Shape of Malt
  - Husk Intact?
- Foreign Material
Malt Sensory Methods

Whole Kernel Chew (Easy)

- Texture
- Husk
- Friability
- Raw Flavour
- Moisture Content

Crystal Malt
Hard

“Slack” Malt
Soft

Non-Crystal Malt
Crunchy
Malt Sensory Methods

Congress Mash

- Need an automated mash bath
- 50 grams of milled malt
- 200 milliliters of distilled water
- Mash at 45°C and hold for 30 minutes (113°F)
- Raise 1°C/minute until 70°C is reached
- Hold at 70°C for 60 minutes (158°F) – Iodine test after 5 minutes to confirm starch conversion
- Cool to room temperature within 15 minutes
- Add distilled water to mash until it weighs 450 grams and stir
- Filter through funnel with fluted filter paper into 500 milliliter flask
- Pour first 100 milliliters of filtrate back into filter
- Collect 200 milliliters
Malt Sensory Methods

Congress Mash

Designed for **MAXIMUM THEORETICAL YIELD** from the Malt

– Conversion Occurs
– Sugars!!!
– Typically around 8° Plato
Hot Steep Method

- How?
- Why?
- Equipment
- Method
Malt Sensory Methods

Why Was the Hot Steep Method Developed?

Flavor gap identified by the Brewers Association

Standardization facilitates communication

And

Consistency
Malt Sensory Methods

How and Who?

Developed at Briess
Beta tested by Briess, New Belgium, and Highland
Validated by ASBC Sensory Technical Subcommittee
Validation method developed by Lindsay Barr
Malt Sensory Methods

What is the Hot Steep Method?

Rapid wort preparation procedure developed for the sensory evaluation of extractable malt attributes.
Malt Sensory Methods

Equipment Required

Supplies can be purchased from a general retailer…

- Scale
- Filter paper
- Insulated thermos
- Electric kettle (optional)
- Graduated cylinder
- Electric grinder
- Tall glassware
- Plastic funnel
Malt Sensory Methods

How to Perform the Hot Steep Method

In home demonstration of Hot Steep method
https://www.youtube.com/watch?v=NJWRpihU84Y

Whole kernel vs. ground malt, milled for 10 seconds in electric coffee grinder

Hot Steep wort filtration
Malt Sensory Methods

Hot Steep Methodology

- 50 grams of milled malt
- Ground to a coarse flour
- 400 mL of 65°C distilled water
- Combine and shake in Thermos – wait 15 minutes
- Swirl then filter
- Filter through funnel with fluted filter paper into 600 milliliter flask
- Pour first 100 milliliters of filtrate back into filter
- Collect 200 milliliters
Malt Sensory Methods

Specialty Malt Considerations

Specialty malts with insufficient enzymes

Prepare: 50% sample, 50% base malt

Base malt is used to facilitate conversion and prepare a standard wort that is more relevant to brewing usage rates
Dark Roasted Specialty Products

Prepare: 15% sample, 85% base malt

Base malt is used to reduce the intensity of overwhelming roasted flavor and prepare a standard wort that is more relevant to brewing usage rates.
Sensory Evaluation

- Overview
- Visual
- Aroma
- Taste
Sensory Evaluation

Overview

- Clear, plastic cups (less than half full)
- Water and unsalted crackers

Evaluate:
- Visual
- Aroma
- Taste
- Mouthfeel
Sensory Evaluation

Visual

We look at wort with our eyes to evaluate color and hue of products.
Sensory Evaluation

Aroma

We smell and swallow wort to perceive aroma attributes

Most aromas present in malt result from non-enzymatic browning reactions that occur during heat processing conditions – Maillard Reaction

Raw, starchy, and grassy type flavors can result from lack of processing
Sensory Evaluation

Taste

We swallow wort to evaluate taste:

- Sweet
- Sour
- Salty
- Bitter
- Umami
- Fat

grainy

burnt sugar

bready
Sensory Evaluation

Mouthfeel

We swallow wort to evaluate mouthfeel:

• Body (thick to thin)
• Astringency (low to high)
• Cloying (low to syrupy)
• Coating (low to slick)
• Mouth watering (low – high)
You can’t really begin to describe the sensory aspects of malt without the proper language...
GWM Malt 7-Point Wort Spidergraph

Name:________________________

Wort: 
Date: 
Comments:

Sweet
7

Tart
6

Malty
5

Burnt
4

Caramel
3

Coffee
2

Biscuit
1

Chocolate
0

Earthly

Nutty
THE DEATH OF BARLEY!

I'm just a widdle barley corn!
Why, it's getting warm...
Gee, it must be Spring!
It's time for me to become a full grown plant!

I've got to grow enzymes
To convert starch
I'll need lots of energy to become a barley plant
OH! OH! It's getting too HOT!

I'm DYING!
Well, I'm done Malting!
Professor! There's protestors outside!
AN ACROSPIRE IS A LIVING BEING!