To Mash or not to Mash Kurz / Hoch
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Introduction

The Kurz /Hoch method of mashing was recently advocated when both studies at Weihenstephan State University and reports by Michael J. Lewis and Tom W. Young (Brewing, Second edition, p.244) confirmed the following: wort dextrins have no flavour of their own and are not viscous enough in solution to account for the perceived (sensory) viscosity or "body" of beer. Something else (the subject of current research) contributes to the perception of "body" in beer, not dextrins. It is thus assumed that traditional complex mashing regimes which were done to promote dextrin formation in order to promote "body" are redundant. The main question to ask if you are considering mashing Kurz/ Hoch is: "What malt am I going to use?" The Kurz /Hoch mashing method is not suitable for cereal adjunct inclusions.

1. Mash short

With the great excess of enzymes in modern malt, conversion can be achieved a lot faster than once believed (remember almost all fully modified malts are designed for big brewers with high cereal adjunct rates). The less time spent mashing the better. 20 Minutes maximum at conversion temperature. The underlying principal is to create maximum extraction with minimum grain contact time.

2. Mash high

Mashing is a beta-amylase sensitive (and therefore a fermentability sensitive) event. . The following arguments demonstrate that mash conditions, especially temperature range must primarily be chosen to accommodate the enzyme content and degree of modification of the malt.

- When malt is poorly modified (or not as well modified) the brewer's window is higher on the temperature scale, say 67-70°C. Thus poorly modified malt must be mashed hotter than well-modified malt to achieve adequate extract yield. To produce the required level of fermentability, the malt must also have sufficient enzymes (especially beta-amylase) to survive the higher mash temperatures used. This malt is thus suitable for Kurz/ Hoch mashing.
- Brewers Window: It is the temperature range where both Alpha- (AA) and Beta-amylase (BA) work "in concert" to create the required degree (for beer type) extraction and fermentability. * When malt is thoroughly modified (well-modified) with just adequate enzymes the brewers window of mashing temperature is lower on the temperature scale, say 65-67°C.
- No respected maltster will produce malt which is both poorly modified and low in enzyme so we can exclude that option.
- Traditional British two row malt, for which the longer rest, single temperature infusion mash was developed are very well-modified malts (but with quite low enzyme content) which can only be mashed successfully at low temperatures (say 65°C). Because the starch dissolves easily, enzymes are conserved sufficiently at these low temperatures so that adequate fermentability can result over say 60 minutes.
- The ideal malt for the Kurz /Hoch mashing method would thus be well-modified malt with also a high enzyme content. Does the Pale Malt from Southern Associated Maltsters fit this specification?

3. Mash dilute (3L/kg)

The often reputed advantages of thicker mashes are a lot of baloney. Enzymes might survive longer in thicker mashes but do less useful work – so what's the point? Thinner mashes generally convert faster, have higher extract yield, and are less prone to darken. When mashing thinner cut back on sparge-water quantity to avoid over-extraction. Thicker mashes do cause more caramelization and Maillard reactions but is far less efficient than when the maltster creates it.

4. Mash in a single vessel of the correct design.

During infusion mashing it is the malt grist, mainly the husk material, which forms the filter bed at the bottom of the mashtun. At the start of the infusion mash this layer is separated from the false bottom of the mashtun by a liquid layer of dense extracted malt sugars. The floating of the filter bed depends on a suitable coarse crushing of the malt and partly on the presence of air bubbles on, and entrapped within the husks. In this case the mash is not stirred. Wort filtration thus takes place in the grain bed itself and not on the slotted false bottom of the tun. The mashtun configuration should be slightly wider than it is deep. The malt bed upon compaction at the end of runoff should not be deeper than 25cm. If it is deeper, efficient sparging will not be possible and the bed will "set" before enough of the good runnings can be extracted. Applying less dense sparge liquor also makes the bed less buoyant and so over time the mash sinks and the bed eventually compacts under any runoff regime. Skill is required to control the flow rate so that enough of the good worts are out of the bed before it collapses.

5. Mash at 5.3 pH.

pH affects the flavour of beer, its flavour stability and resistance to spoilage craft-organisms. Substances such as phosphates and products of protein breakdown in wort act as salts of weak acids at wort pH. Wort pH is often adjusted by addition of lactic acid but the pH change is relatively small because of the buffering effect. A salt of a strong acid and a strong base (like NaCl, the salt of hydrochloric acid) on the other hand provides no buffering action and adding the acid or the base changes the pH immediately. Buffering capacity is very important in brewing since it controls wort and beer pH. Overall, the optimum pH for enzymes that is active during mashing is pH 5.3 – 5.4. If the pH is higher than this, breakdown of proteins, starch and large dextrins is less efficient. This results in slower wort separation at the end of mashing, lower extract, lower soluble nitrogen and FAN concentrations and often lower fermentability. At higher pH values more polyphenolic material is extracted from the cereal husks with resulting astringency and unwanted increased colour. It is therefore good brewing practice to reduce water hardness by reducing the bicarbonate concentration of brewing liquor to less than 20mg /L (20ppm). One method is by adding phosphoric acid to the hot liquor tank and overnight heating to above 90°C. The mashtun pH is then further reduced to 5.3 - 5.4 by adding calcium sulphate and or lactic acid to the mash. The pH at the end of boiling also to a large extent determines the pH of the final beer. In general the pH decreases by about 1 pH unit during fermentation. 5.2 pH pitching wort thus usually gives a beer with a pH of about 4.2.

6. Use a single step rest only if your malt allows it.

Start sparging immediately with 76°C water which will aid in increasing the bed temperature – no mashout is done.

7. Add an antioxidant.

It is now realized that oxidation during mashing has several unwanted effects. Wort gets stale. Proteins containing free-Sulphur Hydrogen groups are oxidized and sulphur-sulphur bonds then formed between them can cause these proteins to form a coating on starch and malt endosperm cell wall fragments. As a result proteolysis, amylolysis and Beta-glucan breakdown are partially inhibited, causing a decrease in the amount of soluble extract obtained, and slows down mash separation. Oxidation of the mash also results in the oxidation of polyphenols. This causes increased colour and astringent bitterness. Even worse, lipid oxidizing enzymes oxidize unsaturated fatty acids and form products that accelerate stale flavours in the finished beer. When using dry milling and dumping malt in through the top of the mashtun air is trapped in the husks again increasing oxidizing potential. Our tiny mashtuns have loads of surface area with air exposure per volume, compared to enclosed mashtuns and bottom filling of big brewers. Good quality sweet wort has a fresh flavour and sparkling quality. This freshness is greatly diminished with long mashing times. Wort tastes dull and bland after a few hours and is irreversible damaged due to oxidation processes. The impact on the final beer is a lack of certain positive flavours – less maltiness, greater astringency and overall dull flavour. Other severe forms of staling (cardboard, aldehyde) may result. Fortunately all this is preventable with the simple technique of adding 20-30 ppm KMS to the mash. There is even now a special kind of anti-oxidant malt that is produced in Europe.

8. Crush coarse gelatinize well.

The Kurz / Hoch regime advocates a gentle vorlauf of 5-10minutes after the 20minute stand until runnings are clear and then runoff. One primary objective of milling is to leave the malt husk as intact as possible. An intact husk, including absence of shredded husks, helps wort separation in lautering and may reduce extraction of tannins, beta-glucans, silica and other undesirable components. Crushing finer will produce a smaller particle which more easily yield extract and probably yield higher extract, but comes with the risk of a stuck mash. Larger particles (from coarser crush) allow faster wort separation but come with the risk of extract loss. Mashtuns, with their deep grain beds, require coarse milling of malt. Coarser crushes will also allow ease of “mashing in” because it does not tend to form clumps and clots like finely crushed malt.

9. Sparge with 76°C water and pH of sparewater 5.5.

Higher temperature and pH during sparging increase polyphenolic material extraction with resulting astringency.

10. Stop runoff at 1010 and 5.5 pH

Extract recovered at the end of sparging is not simply diluted (quality) first wort. Last runnings contain little of interest to brewers making quality beer. Although large breweries have financial interest in collecting last worts as low as 1.003, craft brewers rarely collect below 1010.

11. Buy your Maillard compounds don’t try to mash them!

Many homebrewers have some fantasy image of immense malty flavours emanating from a decoction, but the reality is that decoction imparts only a subtle flavour difference. A no sparge will outdo a decoction every time! Adding a little additional münich, vienna or melanoidin malt will do the same.

12. Use quality malt!

The role of quality base and specialty malt in recipe formulation is going to become far more crucial in times to come. If your malt is likely to throw a haze use nitrogen dilutant or mash in at 58°C for a touch of proteolysis (15 minutes) then step up to 68/70°C. The most obvious time to degrade protein is during malting, when a full complement of proteases and peptidases are present. The vast bulk of amino acids are thus formed in malting, not mashing. In the malting of well-modified malt, more than 40% of the protein is broken down to soluble components. The “protein rest” in mashing is thus probably a misnomer because extensive proteolysis is unlikely in mashing due to the many protease enzymes that are inactivated during the kilning and the short duration of the low temperature stand. Solubility characteristics commonly define barley proteins. The less easily dissolved proteins dominate in high-protein barley. The ratio of the total soluble nitrogen (TSN) to total malt nitrogen (TN) is expressed on malt spec sheets as the Kolbach index. Too high and you’ve got problems associated with too much proteins in the beer like chill haze. Too low and there is no foam on the beer. Two row barley malt has lower nitrogen and protein content and also lower husk content. Six row barley malt has a higher nitrogen and protein content (is less modified) and a higher husk content. It has a higher diastatic power (more enzymes) so it is the malt of choice when large amounts of cereal adjuncts like maize grits are used (in double mashes). The extra husk aids in providing a lautering filterbed.