

Brewing operations

Milling of malt - Mashing (converting the starch)->

Wort separation (filtering the mash) ->

Trub separation (whirlpool) ->

Mashing (important step, time and temp)

Infusion mashing: one vessel

Decoction mashing: two vessels, better if you can't control temps

Grist load 20% spent grains

out of the rest, 65% are fermentable sugars, rest are not

maltose, maltotriose, fructose, glucose, sucrose

unfermentable are dextrins, proteins, gums, pentose, minerals

Lautering

Lauter tun or mash filter

First wort - sparging - last runnings - spent grain removal

boil wort 4-10% evaporation, boiling about 60 mins, hop added

Milling

Objectives crush husks to expose endosperm

completely disintegrate endosperm to make all constituent available for enzymes

keep fine powder at minimum

Prevent extraction of unwanted substances during mashing

Milling types Hammer mill: fine pieces. used for mash filters

Roller mill: husk not damaged, must be used for filtering

From wort to final beer

Whirlpool -> cooling wort ->

wort yeast pitching

aeration ->

Pitching: yeast is mixed with wort

Ale or top fermenting yeast vs Lager or bottom fermenting yeast

The yeast converts fermentable carbohydrates in the wort into alcohol and carbon dioxide

Objectives of mashing (cont)

Purpose To dissolve immediately soluble substances. This fraction constitutes approximately 15% of the total ingredients.

To convert substances that are initially insoluble in the mash into soluble substances, through enzymatic action.

To convert the extracted substances into fermentable extract, through enzymatic action.

alfa amylase cuts big pieces

beta amylase cuts in parts of two

iodine test shows positive test for starch

Heating jacket Limpet coil

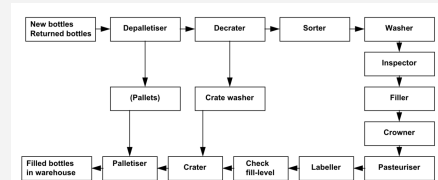
Dimple jacket

Lauter tun Principle: filtration through a bed of grains

Compared to mash filter: • more flexible – variation in brew types and sizes • less expensive • lower yield

Mash filter Principle: • filtration takes place through a filter cloth

Bottling line



Objectives of mashing

Aim to form an extract with a desired profile of sugars and a desired level of proteins, amino acids and other minor chemical constituents

Objectives of mashing (cont)		Malt, hops, Water and Adjuncts		Malt, hops, Water and Adjuncts (cont)	
	Compared to lauter tun: • less flexible – variation in brew types and sizes • more expensive • higher yield	Barley -> Malt	Two-row barley and Six- row barley (two-row better)		PIKE Potassium Isomerised Kettle Extract
Purpose of Wort Boiling and Hopping	Conversion of bitter components in hops from insoluble form to water soluble form – isomerisation of hop α -acids • Extraction of hop aroma • Sterilization of the wort • Adjustment of strength (% Plato) by evaporation • Removal of unwanted aroma components – DMS • Precipitation of proteins and polyphenols – trub, break • Inactivation of any remaining enzymatic activity	Barley composition	Embryo	Downstream	ISO extract
			Leaf		RHO, Tetra, Hexa
			Endosperm		Hop Oils and Fractions
			beta glucan walls	Special products	
		aleurone	production of enzymes 71% arabinoxylan 26% β -glucan	Lupulin glands	Alpha and beta acids, xanthohumol
		Endosperm	Storage of starch 75% β -glucan 20% arabinoxylan		isomerisation of alpha acids increases solubility and bitterness. also makes the light struck flavour
		Steeping	grain take up water	Water	At least same quality as drinking water
		Germination	enzymes activated and synthesised, cells walls and protein broken down		Optimization of minerals (dissolved ions) -> Hardness
Hopping	Bitter hops: Hops added in beginning of boiling Aroma hops: Hops added at end of boiling	Kilning	heating to stop enzymatic activity, production of colours and flavours		optimization of pH -> Alkalinity
		Barley Handling	Pre-cleaning, De-stoning, Removal of half grains and weed seeds, Screening		bottom fermented beers (lagers) are brewed with soft water
Wort cooling					top fermented beers (ales, stouts, etc.) on hard and mineral rich water.
Coolship	big shallow trough	Hops (only female hops)	Bitterness, aroma, taste stability	Ground water	very clean, stable low temperature, often very hard but depends on ground composition
Plate heat exchanger	Hot wort runs next to cold water. hot water is recycled, fx in CIP		antioxidants, antibacterial	Surface water	more particles and microorganisms, varies in temperature, often very soft
			foam, cling, lacing	Town water	Really well balanced
		Growth	Upwards, harvested bottom to top	Hardness	Temporary and permanent depending on mineral salts
		Hop products			
		Pellets	Pellets (90 and 45)		
		Isomerised	Iso-pellets		
			IKE Isomerised Kettle Extract		

Malt, hops, Water and Adjuncts (cont)

Adjuncts

Types Peas, Rice, Corn flakes, rye, soya

“ANY CARBOHYDRATE SOURCE OTHER THAN MALTED BARLEY WHICH CONTRIBUTES SUGARS TO THE WORT”

Quality Taste and Flavour Stability • Head Retention • Colour • Degree of Fermentation • High Gravity Wort

Economy Price of the adjunct versus malt • Influence on brewing capacity • Energy savings • Taxation

Gelatinisation Some adjuncts gelatinise at higher temps than malt, so it has to be boiled separately



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cheatography.com/deleted-87776/

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