THE CHEMISTRY OF BEER

BREWING
Water added to produce wort

MASHING
Hops added, mixture boiled

FERMENTING
Yeast added, alcohol produced

COOLING
Mixture cooled to around 10-20°C

MATURING
Left to mature then filtered & bottled

Dried barley added and ground

ALPHA ACIDS
Found in the hops used for brewing; they degrade and form iso-alpha acids, which contribute bitterness. The five main alpha acids are humulone, cohumulone, adhumulone, posthumulone & prehumulone. Humulone is the primary alpha acid in the majority of hops.

HUMULONE

HUMULONE

BETA ACIDS
Beta acids also originate from hops, and add bitterness during fermentation of the beer as they are slowly oxidised. They are considered to have a harsher bitterness than alpha acids. The ratio of alpha acids to beta acids varies from hop to hop, with different ratios preferred by different brewers.

LUPULONE

ESSENTIAL OILS
These contribute the majority of hop flavour and aroma. As they are volatile, they were traditionally obtained by adding hops late in the brewing stage, although modern techniques vary. Though there are 3 key oils, there are 22 known to give aroma and flavour, and over 250 in hops in total.

CARYOPHYLLENE

MYRCENE

HUMULENE

ESTERS
Esters are formed via the reaction of alcohol in beer with organic acids and a molecule called acetyl coenzyme from the hops. They contribute fruity flavours to beers. Different styles of beer require different levels of esters: their production is controlled in ways including the yeast used and fermentation temperature.

ISOAMYL ACETATE (BANANA AROMA)

ETHYL HEXANOATE (APPLE AROMA)

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