

ABInBev

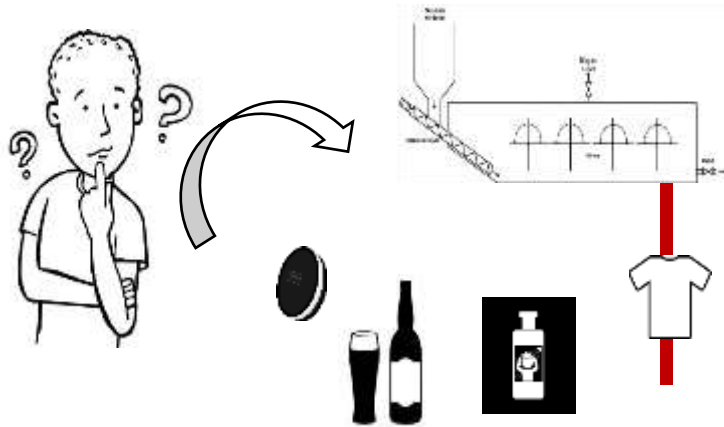


Chemical Engineering and taste.....

Learnings from the Brewing Industry

30 August, 2017

Chemical Engineering.....

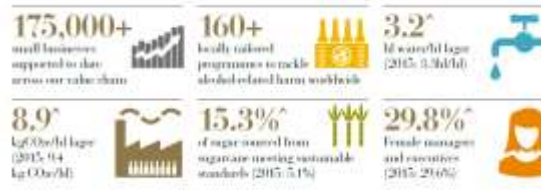


Chemical Engineers are those people who are turn raw materials into useful and consumable items through their knowledge of chemistry and complex physics and process.

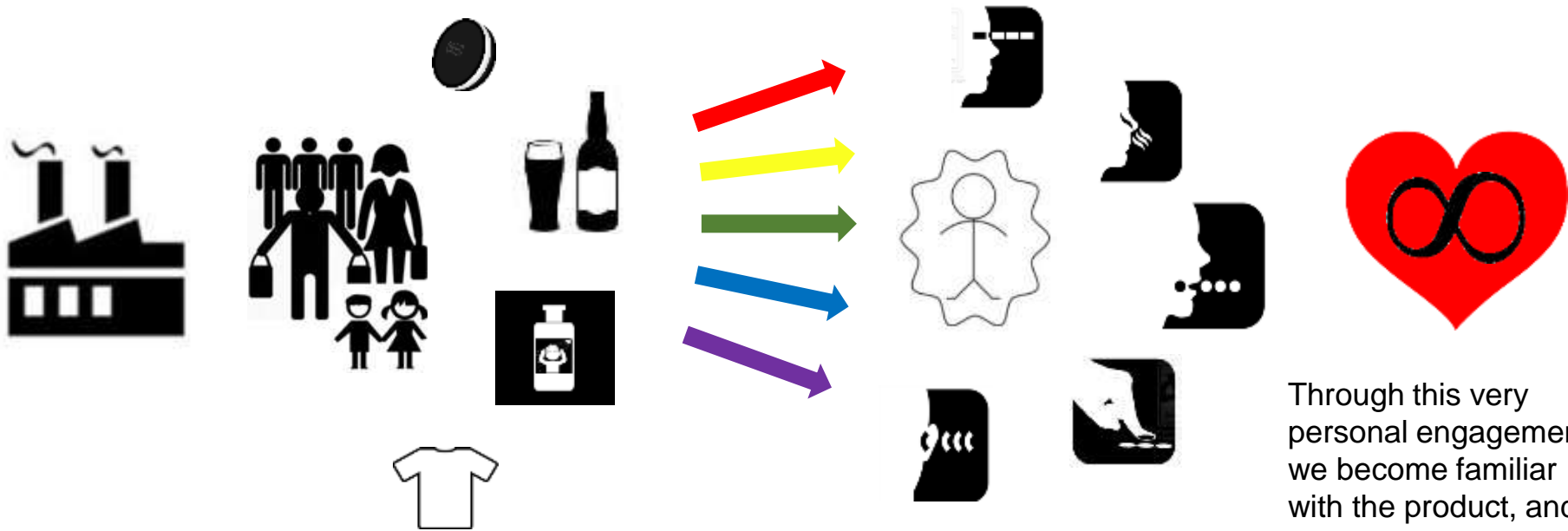
They also use this knowledge to ensure that raw materials and earths resources and used in a responsible and sustainable fashion, protecting both the environment and people.

They often are employed in product development, manufacturing, plant or factory design, risk analysis in fields such as FMCG, pharmaceuticals, petrochemical and consulting.

They are often involved in projects that focus on environmental targets and “triple bottom line” reporting.



Production and Sensory – and why is this important?



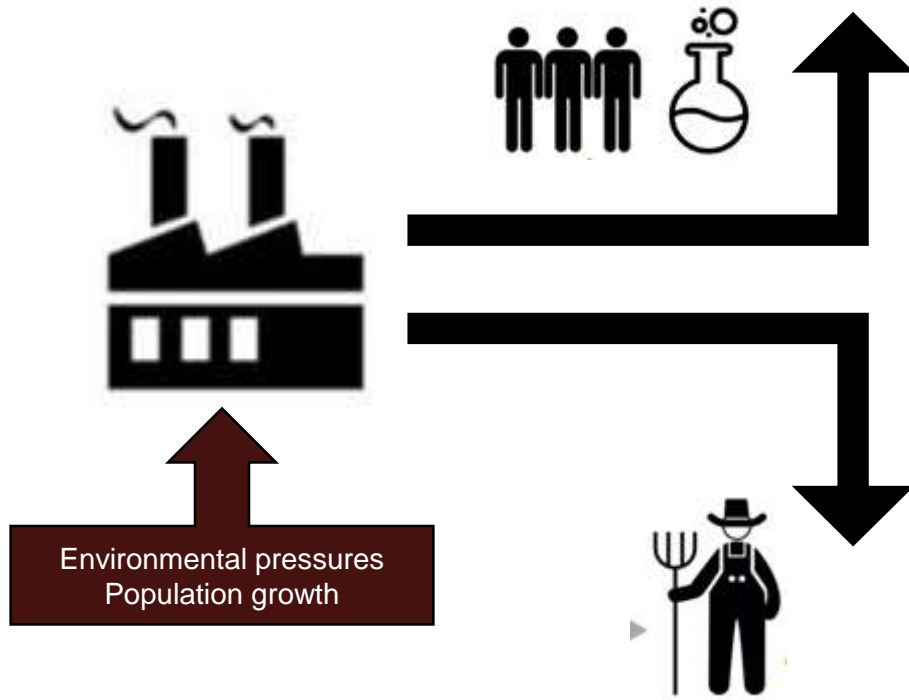
Industry creates FMCG for consumers to use, to fulfil a purpose or functional benefit

Every product used enters our personal space, and engages with one or more of our 5 senses.

Through this very personal engagement, we become familiar with the product, and develop a love, or loyalty for the product.

So what happens if this product changes? Colour, texture, aroma, sound?
What happens if these changes are constant?

Chemical Engineering – what does this have to do with taste?



Greater Productivity

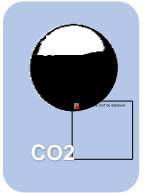
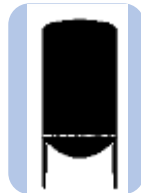
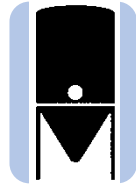
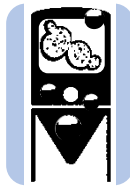
- How can we do more, and how can we do it so it costs us less?
- How can we be more efficient?



New Process

- How can we reduce our impact on the environment (less water, less electricity, less emissions)

Process Engineers are often at the heart of process and product changes.....



Packaging

Milling

Mashing

Lautering

Wort boil

Whirlpool

Cooling

Fermentation

Storage Filtration

In beer production, there are many process steps, each associated with specific quality and process performance requirements.

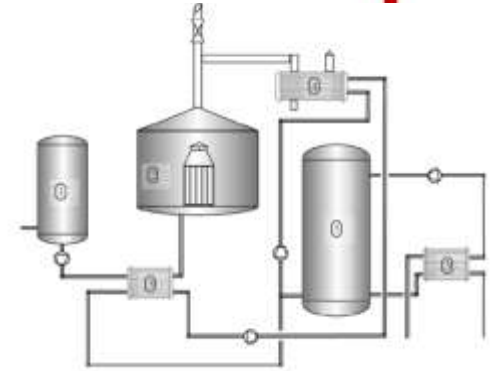
There are some 140 sensory checks for each batch.

We will look at 4 areas in production where the role of the process engineer, and their understanding of sensory impacts are critical.

Dynamic Wort Boiling



BUT it is one of the most energy consuming steps in Brewing



Wort boiling

- Sterilises the wort,
- Allows the development of flavour and colour character,
- Reduces water through evaporation,
- Acidifies the wort and
- Converts the various hop components into bitter substances
- Strips the wort of undesirable volatiles
- Creates a hot break

***What if we could boil with less energy?
Can we get the same evaporation and chemical changes in a shorter time with less force evaporation to increase with less energy?***

Dynamic Wort boiling

- Heats the wort under pressure circa 150mbar, Boiling temp 103°C
- On pressure achievement, it is reduce rapidly to 50 mbar, temp to 101°C
- This cycles around 6 times in the process resulting in flash evaporation
- Bubbles form within the kettle and this produces a stripping effect
- Bigger vessels

Dynamic Wort Boiling – and Sensory



DMS

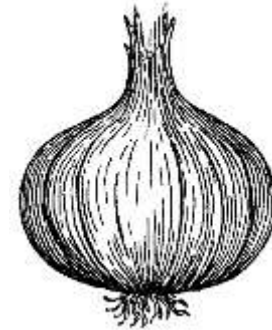


Dimethyl Sulphide – DMS

A sulphur that is present in the malt, through the precursor s – methyl methionine (SMM).

During boiling this is volatilised.
Ineffective boiling results in carry over.
A very recognisable flavour and imparts a distinctive character to lagers.

Onion

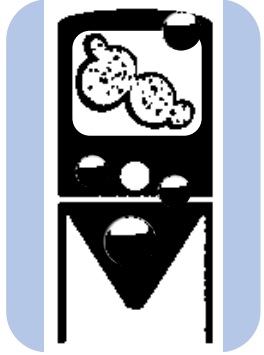


Dimethyl trisulphide – Onion

A sulphur that is present in hop components.

Generally unwanted in lager style beers. Like DMS, it is volatilised during the boil.
Distinctive.

High Gravity Brewing & Fermentation



**WHY
would
you do
this?**



High gravity brewing & fermentation

- Simply the creation of a concentrated wort
- Fermenting in a more concentrated manner
- And then correcting the “concentration” of the green beer to be = to standard gravity.

***It allows extra capacity
without purchasing bigger
equipment.***

***But has several extra
considerations:***

- ***Mass balance***
- ***Water availability***
- ***Yeast pitching rate***
- ***Yeast health and stress management***

Yeast derived fermentation flavours

Iso Amyl Acetate

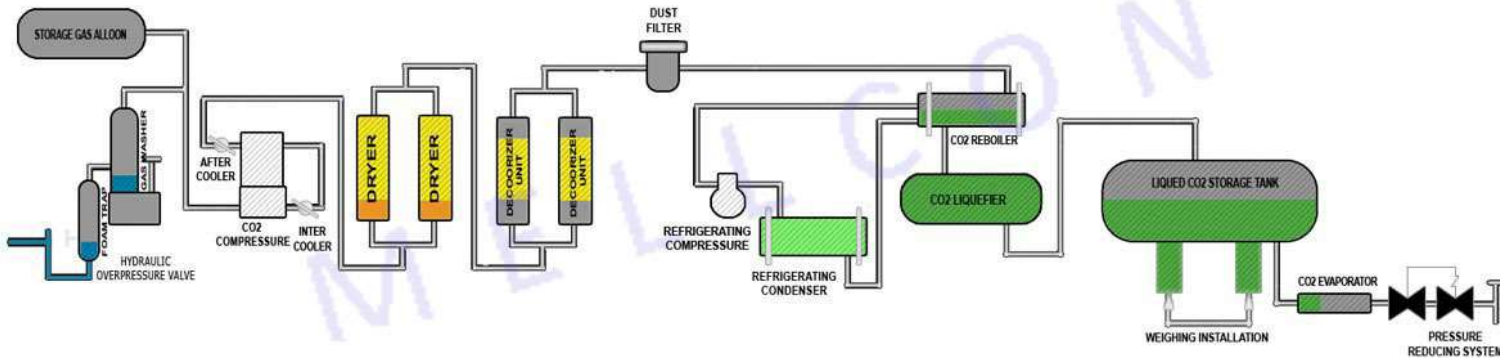
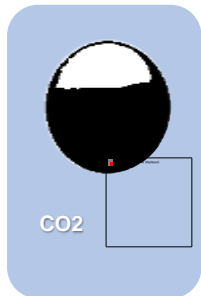
A lovely banana aroma, produced by yeast during fermentation



Factors such as temperature, pressures, pitching rates and affect production of easters

Breweries employ QA processes and taste to ensure that there are no changes to the sensory character of the product.

CO₂ Collection



CO₂ Collection

- Follows the principals of reuse and recycle!
- Almost 50% of the by products of sugar conversion to alcohol is given up in CO₂
- The CO₂ is evolved during the fermentation process, along with a whole lot of volatiles (SO₂, H₂S, acetaldehyde, esters, other)
- Much of this is removed in the dryer/scrubber, and
- Deodoriser



Many cost saving and efficiency initiatives have worked to reduce the frequency of regenerating the dryer and deodorisers in CO₂ collection.

Consequently – sensory tests of the CO₂ gas are conducted to ensure that CO₂ is in fact clean and does not contain the odiferous molecules.

Sensory Systems

Chemical analytical capability vs Trained assessors



Should process engineers be tasters?

What learnings can be gotten from other industries?

Share experiences.