The IBU Method, its Creation and what it Measures

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History of the IBU

- Lloyd Rigby - 1955

  Canadian Breweries Ltd.

First practical & quick method for determining "iso-compounds" in beer or wort

Extract acidified beer with TMP, dilute extract with basic MeOH and measure absorption @ 255nm

1919-2008

Morten Meilgaard Modification Carlsberg Laboratories - 1955

- Wants to measure not only “iso-compounds”, but all hop derived bittering substances.
- Don’t measure @ 255nm in base, but @ 275nm neutral.
- This is essentially the method used today – but takes many years to be accepted by the ASBC and EBC in the late 1960’s.

The Fight (1955-1972)

- Rigby wants to measure only “iso-compounds” and assumes the interfering compounds are not important.
- Meilgaard assumes all hop derived compounds contribute to bitterness – especially oxidation products formed during aging of hops, and wants to include them all.
- What is this all about?

Brewing in 1955-1970

- Hop pellets do not exist – almost all brewers uses whole hops and these are NOT cold stored. Hops are 9-15 months old on average when used and 25-50% of bitterness comes from oxidation products of α & β.
- Almost no one dry hops, lager beers are the only consideration in designing IBU method.
- Dry hopping adds many new complicating substances to beer.

The Compromise

- Some want IBU = ppm iso-alpha.
- Others say oxidation products responsible for 25-50% of bitterness of commercial beers.
- The IBU measurement will include all oxidation products, but will be calibrated to have IBU's = ppm iso-alpha when $5/7^{th}$ of bitter substances are iso-alpha. This leads to great misunderstanding of what the IBU measures.

The Compromise Multiplier

True iso-alpha method with all interfering substances removed:

IBU = ppm iso = 70 X Absorbance (@275nm)

Compromise method includes interferences:

IBU = 50 X Absorbance (@275nm)

So IBU's approximate ppm "iso" in most beers of the time.

The Peacock Rule

IBU's = 5/7(ppm iso + ppm non-iso)

This explains relation of IBU's and ppm iso in beers

Age fresh hops 18 months and make beer with same amount of hops in each brew

Storage Temp.	Alpha Acids In Hops	Iso-Alpha Acids In Beer	Beer IBU's
-15° F	3.22%	19.8 ppm	13.5
25° F	2.91%	18.1 ppm	12.0
45° F	1.71%	14.4 ppm	13.5
70° F	0.41%	2.9 ppm	11.0

Hop Oxidation and Quality of Bitterness

- Even though VERY oxidized hops may give comparable IBU levels as fresh hops, there are large qualitative differences.
- The bitterness of beer with largely non-iso-alpha bitterness (from old hops) will be harsher and more lingering than beer with the same IBU's of iso-alpha.
- Foam will be very much inferior in beer made with old hops.

The Peacock Explanation 2007-2014

- IBU = 5/7 (iso-alpha + non-iso-bitterness)

- Luke Chadwick (2014) question - Why not:

IBU = 5/7(iso-alpha) + non-iso-bitterness

But what is the proper multiplier for non-iso?

The 2014 Peacock Explanation (Dry-Hopping)

IBU = 5/7(iso-α) + ***X1***(non-iso-α) + ***X2***(α ox. Prod.) + ***X3***(Xanthohumol) + ***X4***(iso-XN) + ***X5***(β) + ***X6***(β ox. prod.) …..

If you know the absorbance of these fractions @ 275nm, the multiplier can be readily calculated (assuming 100% extraction efficiency). Other nm? 325, 370?

Conclusions

- The current IBU method measures a multitude of things in beer – not just iso-alpha.
- The original method was developed for lager beers (no dry-hopping) made with very oxidized hops. Different from iso-alpha method.
- Dry hopping and use of hop pellets or extract greatly changes the relation of iso-alpha to IBUs. Does the current method need modification?