

DOES IBU MEASURE ONLY BITTERNESS OR MUCH MORE?

By Robert T. Foster, II

In the 1950s, both in Europe and America, there was much research regarding the measurement of iso-alpha acids in beer. During this time, Drs. Rigby and Bethume developed a spectrophotometric method that measured the International Bitterness Units (IBU) in beer. Hop research at that time was focused on the degree of bitterness from iso-alpha acids and the conditions to improve isomerization of the alpha acids to save hopping costs. The iso-alpha acids curve developed by Drs. Rigby and Bethume for beer is sigmoidal in shape and, fortunately for the lager and ale beers of that era, it is linear between 15 and 35 IBUs. So, the IBU method was developed for brewers to get a rapid read on their bitterness in their lagers and ales.

In the 1960s and 1970s, brewing chemists determined that the IBU level also included cumulative absorbances from bittering compounds other than iso-alpha acids, namely beta-acid oxidation products like hulupones, lupoxes, lupdioxes and lupdeps, which are about half as bitter as iso-alpha acids. Many brewers started to realize their kettle hops were too old as these oxidized beta acid derivative compounds came from older, oxidized hops and had harsh, cheesy, and off-flavors. Hop varieties that did not store well like Cascade hops actually lowered the sensory bitterness taste of these lagers, even though the analytical IBU remained fairly consistent. In this same time period, Dr. Didac determined hop polyphenols added astringent or harsh flavor sensations to beer depending on the oxidation state of the polyphenols or age of the hops. The polyphenols also contribute to the total absorbance in the IBU determination.

Then came the reduced iso-alpha acids in the 1970s through the 1980s, namely dihydro-iso-alpha acids, tetrahydro-iso-alpha acids, and the hexahydro-iso-alpha acids. The iso-alpha acids sensory bitterness is considered 1.0 and the sensory bitterness of the above mentioned bitters are 0.7, 1.6–2.0, and 0.8–1.1, respectively with regard to iso-alpha acids. Also, the less bitter dihydro-iso-alpha acids reportedly have a short duration impact after swallowing, whereas some tetrahydro-iso-alpha acids have a lingering duration of bitterness. Since absorbance is cumulative to the total IBU level of beers that use these reduced iso-alpha acids, the sensory and brewing chemists had to determine the impact of these reduced IBUs on the drinkability of their beers.

In the 1990s, the English style late- and dry-hopping techniques were used initially by American craft brewers to introduce various new styles of IPA-type beers, and that persists to the present time. Dry hopping added many more UV-absorbing compounds to the total absorbance of the IBU method derived from the hop oil terpenes and sesquiterpenes that have piney, citrus, floral, fruity, herbal, etc. hop flavors. Also, the dry-hopping derived humulinones are 0.66 as bitter as iso-alpha acids (Maye and Smith, 2016). With huge IPAs

using high quantities of hops in dry hopping, the bitter tasting alpha acids are also solubilized in the fermented beer.

So, to answer the original question, you can see the IBU method of old does not just measure bitterness of a beer, but rather, as referred to in the Old-World jargon, it measures the total hop "bouquet or hoppy character" of a beer. Getting your hops right for your special style of beer is still an art and requires brewers' expertise, and that is probably why brewers still favor the IBU value. If New-World brewers want to identify the component makeup of their beers to make the hop bouquet more consistent year to year, they will need HPLC and GC-MS instruments. However, brewers will still need an IBU value to control all the components of hop bitterness and flavor.