

# WORLD BREWING CONGRESS 2016

## A Novel Approach to Increase Hop Efficiency

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#### Introduction

Hops are added to beers for 2 reasons. Bitterness and overall hop flavor formation. When the 1<sup>st</sup> addition of hops are added to the boil, the goal is to extract the active humulone components – for simplicity, let’s also included all the cohumulon, iso humulone, adhumulone and pre and post humulones.

As these humulones are extracted and when heated in the boil, they isomerize to form their alpha acids. These alpha acids impart the bitterness that give the beer its wonderful bitter flavor.

It is estimated that 20% of the humulone is typically extracted and makes its way into the beer. It is also estimated that 20-30% of the humulones are in the spent hops.

That means that they never made it out of the spent hops because they simply can’t due their poor water solubility. If you could extract more of the humulones, they you would have more alpha acids. More alpha acids means more bittering.

Additional flavor chemicals can also be extracted using this method, but that’s another paper.

#### Hypothesis

Increasing the solubility of the humulone, will yield higher IBU’s in a finished beer. By using ProRyza Brew as a non polar solvent, we should be able to extract additional humulone from the hops. Additionally, the non polar nature of the ProRyza Brew will change the surface tension of the yeast cells and cause them to be less likely to bind with the alpha acids during fermentation.

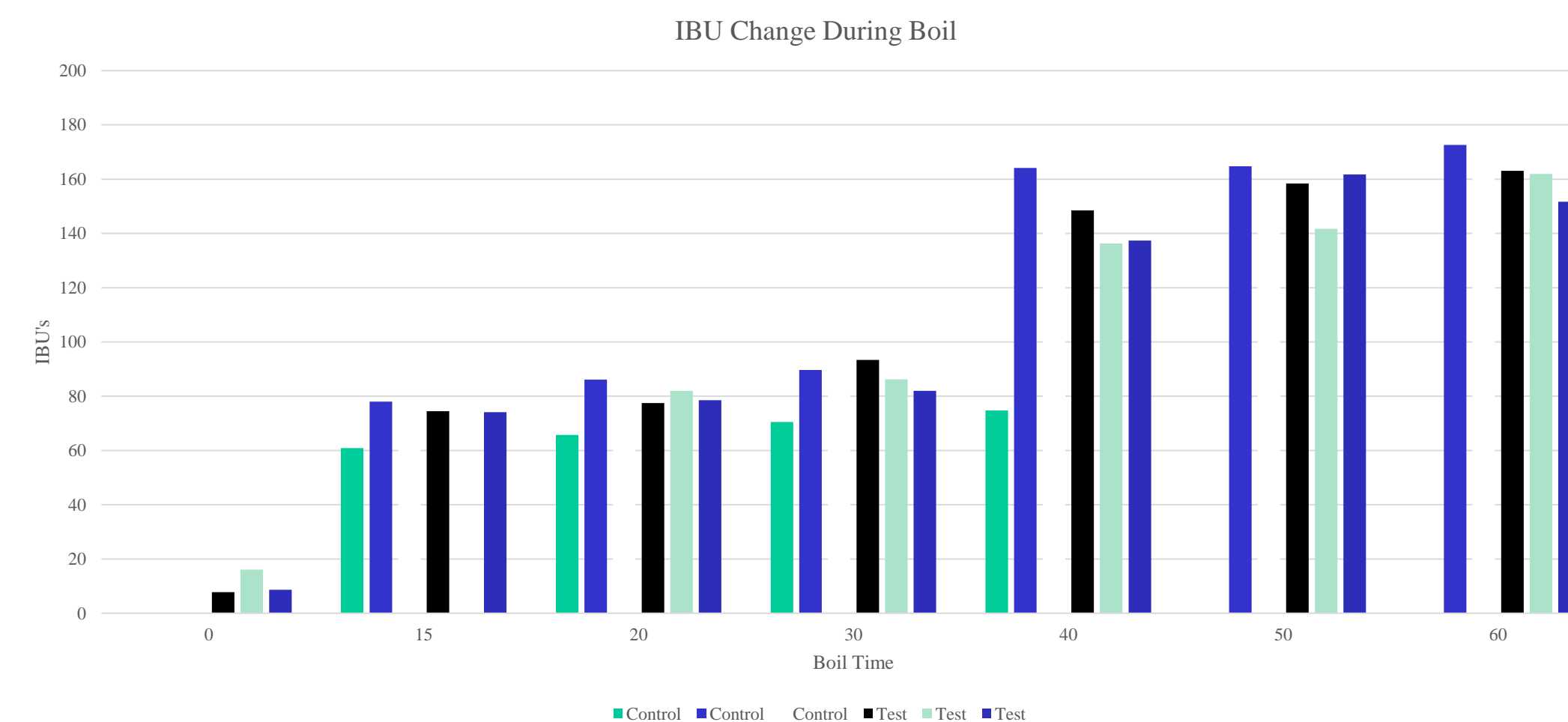
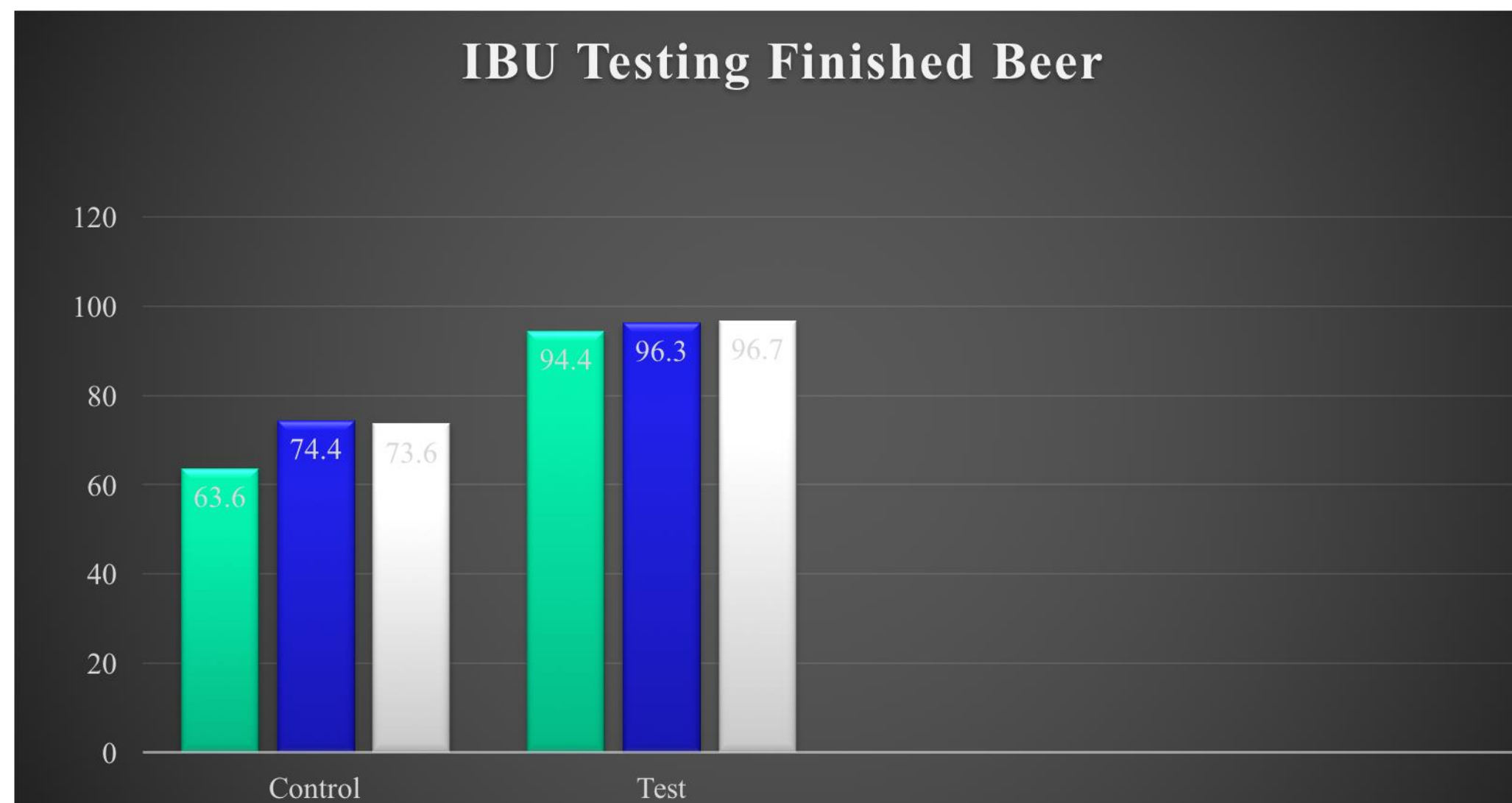
#### Prediction

If we can increase the solubility of the humulone from the hops, then we will see a beer with a higher IBU than the control beer. Additionally, the change in surface tension should reduce the yeast affenity to bind with alpha acids when settling keeping more alpha acids in the finished beer yielding a higher IBU.

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#### Results

IBU’s of a control and test beer were run and the highs and lows were measured. With this formula, we consistently see a increase of 29% in finished beer IBU’s.



IBU formation was looked at over a 60 min boil.

#### Methods

A Pico Brew machine was used to insure consistency. A simple 2 row formula was used with a target IBU of 74. OG 1.049 FG 1.007  
 IBU’s were measured using spectrophotometric iso-octane analysis  
 HPLC data was collected to look at alpha and beta acids.  
 Fermentations were observed.



#### Discussion and Future Work

The 29% increase in finished beer IBU’s does vary with the hops used. We have seen higher than 29% and lower. The actual mechanism is still unclear. Fermentation seems to be very different and work needs to be done to better understand the surface tension and the acid/yeast interactions. It looks like it’s more the increased humulone solubility. The next step is to use a hop extract – we expect to see even better results due to the hop extract increased non polar nature.