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The Math Works

No matter how much you like or dislike math, it is heavily involved in brewing beer. We are blessed to have beer recipe programs that eliminate the majority of the required math needed when developing a recipe, but sometimes that just is not enough. Here are some math formulas to keep in the toolbox when preparing for or during a brew day.

DME Gravity Correction Equation

Sometimes we fail to hit the gravity we want to hit in a big beer. When the mash extraction falls short to the target we want. It is a simple fix with the right math formula to get our beer to where we want the gravity.

$$\begin{aligned} &(\text{Target Gravity OG} - \text{Measured Gravity OG}) \times 1000 = \text{Points needed} \\ &\text{Points Needed} \times \text{Volume final} = \text{Points needed to raise gravity} \\ &(\text{DME} = 46 \text{ Points per pound}) \\ &\text{Points needed} / 46 = \text{lb of DME needed} \end{aligned}$$

Example

Our target gravity is 1.090, but our measured gravity is 1.070.

$$\begin{aligned} &(1.090 - 1.070) \times 1000 = 20 \text{ Points needed} \\ &20 \times 5.5 \text{ gallons} = 110 \text{ Points to raise gravity} \\ &110 / 46 = 2.4 \text{ lb of DME needed to raise gravity to the target} \\ &2.4 \text{ lb of DME} \end{aligned}$$



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Hop Adjustment Calculation

You have perfected that one beer or your beer program calculated the hop at a different Alpha Acid that you have on hand or bought. But you want the same calculated IBU from the previous beer you made or the one you wrote. The way to do that is to work with Alpha Acid Units. By working with Alpha Acid Units your beer will be more consistent no matter what the Alpha Acid% is. Also, consider using grams instead of ounces for more accuracy. This is how you do it.

$$\text{Ounces} \times \text{Alpha Acid\%} = \text{Alpha Acid Units (AAU)}$$

$$\text{Alpha Acid Unit (AAU)} / \text{Alpha Acid\%} = \text{ounces}$$

$$\text{Ounces} \times 28.35 = \text{grams needed}$$

Example

Let us say that the first time you made a beer that you want to repeat and you were using Cascade hops that had an Alpha Acid of 5.4%. This is how you develop the baseline.

First we need to find out our baseline in for the beer Alpha Acid Units

$$1 \text{ ounce Cascade} \times 5.4\% \text{ AA} = 5.4 \text{ Alpha Acid Units (AAU)}$$

$$5.4 \text{ AAU} / 5.4 \text{ AA} = 1 \text{ ounces}$$

$$1 \text{ ounce} \times 28.35 = 28.35 \text{ ounces}$$

But now you want to make the same beer, but the Cascade on hand is now 4.2% Alpha Acid. Here is how we get to the same as the baseline above by using Alpha Acid Units to be sure that we are making the same beer.

$$5.4 \text{ AAU} / 4.2 \text{ AA} = 1.29 \text{ ounces needed}$$

$$1.29 \text{ ounces} \times 28.35 = 35.57 \text{ grams needed}$$



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Yeast Starter Calculations

Yeast starters do more than just grow yeast to have the proper amount of cells needed for the beer at hand. It also helps strengthen the cells for the upcoming battle between yeast and sugar. A yeast starter is more about growing quality yeast, not just more cells. To do that we need to keep our gravity reading in the 1.038 to 1.040 range to maximize cell growth and healthy yeast.

The first thing to remember is to add in some yeast nutrient in the yeast starter. It doesn't take much, just a $\frac{1}{8}$ of a teaspoon will work. If you are using an erlenmeyer flask to boil in, have some fermcap on hand and add in 2mL to the starter to prevent boil over, it will also help prevent a blowout while the starter is on the stir plate.

The old school way of making a yeast starter was $\frac{1}{2}$ cup of DME per 1L of water. This gets close to the numbers we are looking for in gravity and a quick way to do it.

More accurate is not a formula per say, but more of a guideline to use when making a yeast starter. The ratio is simple and the math is simple. Simple is good.

1 gram DME per 10 mL of water

100 grams of DME = 1 L of water

200 grams of DME = 2 L of water

300 grams of DME = 3 L of water

400 grams of DME = 4 L of water

And so on and so on

If you don't want to do the math yourself, there are yeast starter calculations on the web that you can use or in the beer recipe builder programs. Either way you do it, build that yeast for better beer.