

How Does the TechWizard™ Calculate Density?

Having accurate density values for ingredients and the overall formula containing these ingredients is crucial if you intend to report volume amounts. In most cases you can not simply add up the volume of each ingredient and obtain the total volume of the formula. For example if you add 1 cup of sugar to 6 cups of water you will not have 7 cups of sugar water. The following sections describe how density is handled for an ingredient and a formula.

Density of an Ingredient

The user can simply enter a density value for an ingredient or use one of the available equations to calculate the density based on fat and solids content. There are two equations used by the TechWizard™ to calculate ingredient density. The first is referred to as the USDA Density Calculation for Milk.

The USDA Density Calculation for Milk uses the following equation:

$$\text{Density (kg/L at 40 }^{\circ}\text{F)} = 100 / [100 + (\%BF \times 0.03928) - (\%SNF \times 0.39221)]$$

Density (lb/gal) = 8.3364 x kg/L BF = butterfat, SNF = milk solids not fat

The second method is referred to as the Mix Density Equation. The Mix Density Equation is useful for calculating the density of completely dispersed, water containing liquids such as an ice cream mix.

The Mix Density Equation uses the following equation:

$$\text{Density (kg/L at 60 }^{\circ}\text{F)} = 100 / [(\%fat/0.9) + (\%SNF/1.58) + (100 - TS)]$$

Density (lb/gal) = 8.3364 x kg/L SNF = solids not fat, TS = total solids

Once the user has decided on a method of calculating density or entering values, how does TechWizard™ know how to handle density data for a particular ingredient? TechWizard™ uses a variable, referred to as Volume Choice, which is set by the user for each ingredient to determine how density values are obtained. The Volume Choice can be set to 0, 1, 2, or 3 which corresponds to:

- 0 - No volume for the ingredient is calculated regardless of whether or not density values are provided.
- 1 - Volume calculated using USDA Density Calculation for Milk.
- 2 - Volume calculated using density values provided for the ingredient.
- 3 - Volume calculated using the Mix Density Equation.

An ingredient can also be designated as “bulky”. This means the ingredient will not be adequately dispersed when added to the other ingredients so that neither equation just described to calculate density can not be used. The user must enter a density value for a bulky ingredient. Furthermore, the density equations described above do not apply to dry ingredients.

Density of a Formula

The user can enter the density of a formula. If no density is provided then the Mix Density Equation described in the previous section is used to estimate density. If a formula contains any “bulky” ingredients, the user must enter a density value for the formula.