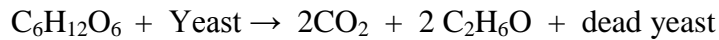
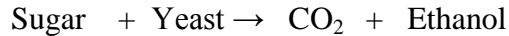




Derivation:



The premise is that for every lb-mole of ethanol produced we get one lb-mole of CO₂.

$$EF = \left(\frac{\text{Vol. Fraction}}{\text{Ethanol in Wine}} \right) \times \left(\frac{\text{density}}{\text{Ethanol}} \right) \times \left(\frac{\text{Molar}}{\text{Ratio}} \right) \times \left(\frac{MW_{\text{CO}_2}}{MW_{\text{EtOH}}} \right)$$

$$EF = \left(\frac{\text{gal EtOH}}{\text{gal Wine}} \right) \times \left(\frac{\text{lb EtOH}}{\text{gal EtOH}} \right) \times \left(\frac{1 \text{ lb - mol CO}_2}{1 \text{ lb - mol EtOH}} \right) \times \left(\frac{\text{lb - mol EtOH}}{46 \text{ lb EtOH}} \right) \times \left(\frac{44 \text{ lb CO}_2}{\text{lb - mol CO}_2} \right)$$

$$EF = (VF_{\text{EtOH}}) \times (6.59) \times \left(\frac{44}{46} \right) \times \left(\frac{1000 \text{ gal}}{1000 \text{ gal}} \right)$$

$$EF \left(\frac{\text{lb CO}_2}{1000 \text{ gal wine}} \right) = 6303 \times VF_{\text{EtOH}}$$

Where VF_{EtOH} is typically:

Red \approx 0.14 (i.e., 14% ethanol by volume)

White \approx 0.13 (i.e., 13% ethanol by volume)

$$\therefore EF \left(\begin{array}{l} \text{red @ 14\%} \\ \text{by Volume} \end{array} \right) = 882 \frac{\text{lb CO}_2}{1000 \text{ gal wine}}$$

$$EF \left(\begin{array}{l} \text{white @ 13\%} \\ \text{by Volume} \end{array} \right) = 819 \frac{\text{lb CO}_2}{1000 \text{ gal wine}}$$

Note: See SBCAPCD Winery Spreadsheet for VOC calculations (www.sbcapcd.org/eng/winery/winery.htm)

By: Mike Goldman

Date: June, 2007