

Problem 3

A publication this year in the journal **Yeast** (who'd have thought!) by a Scottish group described their development of a spectrometric procedure to monitor the concentration of glucose, ethanol, biomass, and protein content in a vat during the production of Baker's yeast (*Saccharomyces cerevisiae*). They used near-infrared spectrometry to perform this analysis. It is a particularly challenging matrix because the large yeast cultures scatter so much of the light. (See Finn, Harvey, and McNeil, *Yeast* **23**, 507-17 (2006).)

A standard addition method is used to determine the concentration of ethanol in an unknown sample. Six 10 mL aliquots of the unknown are drawn from the processing vat. An aqueous solution of ethanol is standardized to have 1.57 g/L. This standard is pipetted to five of the aliquots in the following volumes: 5.00 mL, 10.00 mL, 15.00 mL, 20.00 mL, and 25.00 mL. Each of the six solutions is then diluted to a total volume of 50.00 mL. Three samples are taken from each of these solutions and the absorbance spectrum in the ethanol region is measured and the relative area under the curve is reported. This data is available in the accompanying Excel or pdf file.

Determine the concentration of ethanol in this unknown sample and provide the 95% confidence limits for the answer.

For calculating the confidence limits, take n to be 3, the number of measurements of the unknown by itself and let the number of degrees of freedom be $3-1 = 2$ since the average result is extracted from the data.