

Homework Assignment #2

(For return at the beginning of class, Tuesday, November 30)

The hydrolysis of acetic anhydride is being studied in a laboratory-scale continuously stirred tank reactor (CSTR). In this reaction acetic anhydride $[(\text{CH}_3\text{CO})_2\text{O}]$ reacts with water to produce acetic acid (CH_3COOH).

The concentration of acetic anhydride at any time in the CSTR is determined by titration with sodium hydroxide. Because the titration procedure requires time (relative to the hydrolysis reaction time), it is necessary to quench the hydrolysis reaction as soon as the sample is taken. The quenching is achieved by adding an excess of aniline to the sample, to produce acetic acid and acetanilide. The reaction stoichiometry is:



The quenching reaction also forms acetic acid, but in a different stoichiometric ratio than the hydrolysis reaction. Thus it is possible to determine the acetic anhydride concentration at the time the sample was taken.

The initial experimental design is shown in the figure below. Water and acetic anhydride are gravity-fed from reservoirs and through a set of rotameters. The water is mixed with the acetic anhydride just before it enters the reactor. Water is also circulated by a centrifugal pump from the temperature bath through coils in the reactor vessel. This maintains the reactor temperature at a fixed value. A temperature controller in the water bath maintains the temperature to within 1°F of the desired temperature.

Perform a Job Safety Assessment on this experiment. Use the revised form attached and available as a Word doc download from the downloads page on www.dancrowl.com. Make sure the your document is form protected prior to use. You may locate the experiment in any lab that has adequate safety equipment.

