Continuous Distillation Column

Winter 2007

TO: Engineering Development Branch

FROM: Engineering Division

Re: New Ethanol Pilot Plant

It has recently come to our attention that the ATF (Bureau of Alcohol, Tobacco, and Firearms) has confiscated a large quantity of a 50 vol % mixture of ethanol and methanol. They have traditionally burned such confiscated mixtures, but are now having a problem because the EPA has decided that burning it at the present site is not environmentally safe. The ATF is willing to give us this mixture for the price of shipping it. However, we cannot sell this until we separate it into two streams. The maximum allowable impurity of the ethanol can only be 0.5 vol % methanol and the maximum allowable impurity of the methanol stream can only be 0.3 vol % ethanol in order to sell it. Design a tower (determine height, diameter, reflux ratio, feed location, etc.) using sieve trays that can process 8,000 kg/hr of the above feed.

Use the Oldershaw column (continuous column) in the unit operations laboratory to find the E_{OV}. Find the operating parameters which give high E_{OV} values in the Oldershaw column and give roughly the same recovery of methanol in the distillate and ethanol in the bottoms. You should use reflux ratios in the Oldershaw column higher than the minimum reflux ratio needed in the industrial column. Using procedures found on page 213 of Seader and Henley or in King page 619, find the E_{MV}. Oscarson has summarized the steps needed. Find the number of actual stages and reflux ratio needed for the separation. Use the correlations in Chapter 6 of Seader and Henley to find the correct diameter of the desired column, as well as the downcomer area. Use a weir height of 3 inches. Use a tray spacing of two feet.

It is extremely important that we avoid flooding, weeping, or serious entrainment.