

EXAMPLE 11.4-1. Rectification of a Benzene-Toluene Mixture

A liquid mixture of benzene-toluene is to be distilled in a fractionating tower at 101.3 kPa pressure. The feed of 100 kg mol/h is liquid and it contains 45 mol % benzene and 55 mol % toluene and enters at 327.6 K (130°F). A distillate containing 95 mol % benzene and 5 mol % toluene and a bottoms containing 10 mol % benzene and 90 mol % toluene are to be obtained. The reflux ratio is 4:1. The average heat capacity of the feed is 159 kJ/kg mol · K (38 btu/lb mol · °F) and the average latent heat 32 099 kJ/kg mol (13 800 btu/lb mol). Equilibrium data for this system are given in Table 11.1-1 and in Fig. 11.1-1. Calculate the kg moles per hour distillate, kg moles per hour bottoms, and the number of theoretical trays needed.