APPENDIX C 1. DESIGN OF A STRIPPING COLUMN

Problem Formulation

A stripping column for a 90% removal of ammonia from waste water must be designed. The maximum flow of water is 10 m^3 / h. The ammonium concentration is 80 mg / l. The temperature is 18^0C.

Solution

Equation (7.39) is used to find the diameter of the tower. l_w should be 0.08 or above, but for stripping column it is very difficult to obtain such a high l_w value and therefore it will be attempted to select l_w = 0.04. It implies that a cross sectional area of 4 m^2 should be used according to equation (7.39), giving L = 2500 kg/h/m^2, provided that a is about 60 1/ m. It is the case for 4 inch raschig rings (see Table 7.4), which are chosen. The minimum ratio air to water is about 3000, which is selected. It will correspond to 30 000 m^3 / h air or 36 000 kg / h. It gives a flow rate 9 000 kg / h / m^2 or 7 500 m / h, corresponding to about 2 m / s, which is fully acceptable see Table 7.4.

The flooding point is found from equation (7.40), using Figure 7.14. Q is found to be:

$$Q = (2500 / 9000)^* \sqrt{0.0012} = 0.01$$

which will give a Z value of about 5. As μL is 0,001 kg / m*s and $dh^{3/2}$ is 0,01 (see Table 7.4), l_w is therefore 0.05 or slightly more than found above. which is acceptable.

H_{tG} is found from equation (7.38), as the constants are found in Table 7.3:

NB rigtigt symbol??a = 1.8

ß = 0.4

y = 0.4

Sc for air at 15^0 C can be found from the the viscosity of air (0.0648 kg / m • h), the diffusion coefficient (0.0392 m^2 / h) and the specific gravity (1.2 kg / m^3) to be 1.37. HtG is now found from equation (7.38):

$$HtG = 2 * (9000 / 2500)^{0.4} \sqrt{1.37} = 3.9 \text{ m}.$$

R is found from equation (7.42).

$$R = H * 3000 / 1244$$

Henry's constant i found from (7.11) to be 0.69 bar. Therefore R = 1.66, which by use of Fig. 7.16 is translated to 3 transfer units, as the fraction 0.9 is removed.

The height of the tower is calculated to be 3.9* 3 = 11. 7 m.