Example 7-12

A chlorine dose of 1 mg/liter as Cl_2 satisfactorily disinfects a water at pH 7.0. What dose of chlorine would be required to achieve the same disinfection efficiency if the pH of the water was 8.5? Assume that HOCl is 100 times more effective as a disinfectant than OCl^- and that the temperature is 25°C.

Solution

From Fig. 7-21 at pH 7,

$$\alpha_{Cl_2} = 0$$
$$\alpha_{HOCl} = 0.76$$
$$\alpha_{OCl^-} = 0.24$$

Since $C_{T,Cl} = 1$ mg/liter as Cl_2, HOCl = 0.76 mg/liter as Cl_2, and OCl^- = 0.24 mg/liter.

The relative disinfection effectiveness, HOCl = 100, OCl^- = 1.0.

$$\text{Disinfection effectiveness} = \text{concentration} \times \text{relative disinfection effectiveness}$$
$$= 0.76 \times 100 + 0.24 \times 1.0$$
$$= 76 \text{ units per mg/liter of chlorine}$$

From Fig. 7-21 at pH 8.5,

$$\alpha_{Cl_2} = 0$$
$$\alpha_{HOCl} = 0.09$$
$$\alpha_{OCl^-} = 0.91$$

The disinfection effectiveness is

$$= 0.09 \times 100 + 0.91 \times 1.0$$
$$= 9.9 \text{ units per mg/liter of chlorine}$$

To achieve the same effectiveness of disinfection at pH 8.5, we would therefore need 76/9.9 = 7.7 times the dose applied at pH 7.

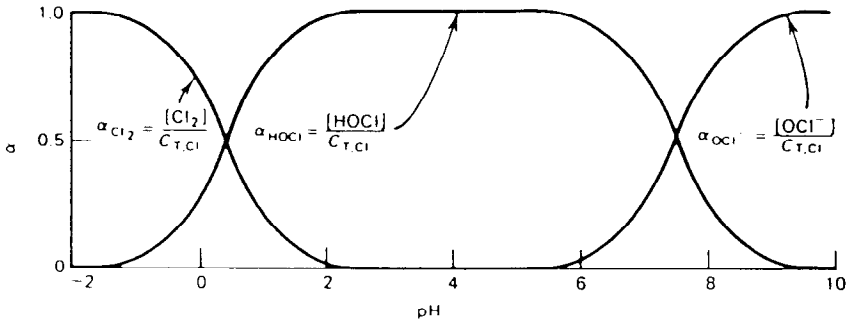

Fig. 7-21. Distribution diagram for chlorine species, 25°C, $[Cl^-] = 10^{-3}$ *M*, $C_{T,Cl} = [Cl_2] + [HOCl] + [OCl^-]$.

CL - 1