EXERCISE CHAPTER 2

QUESTION

An industrial plant discharges wastewater to a surface stream at a maximum flow rate of 20 000 m^3/d, a BOD_5 of 50 mg/L, a dissolved oxygen concentration of 2.7 mg/L and a temperature of 28 °C. The stream just above the point of wastewater discharge flows at 0.84 m^3/s, a BOD_5 of 3.2 mg/L, a dissolved oxygen concentration of 8.7 mg/L and a temperature of 25 °C. After a complete mixing of the wastewater, the velocity of the mixture is 38.9 km/d. Given the reaction rate constant at 20 °C is 0.23 d^{-1} and the reaeration rate constant is 0.43 d^{-1}.

(a) Determine the flow rate in m^3/s, temperature in °C, dissolved oxygen in mg/L and BOD_5 in mg/L after the mixing.

(b) Calculate the deficit (D_t) at 25, 75 and 120 km (in mg/L).

(c) Sketch the dissolve oxygen profile of a 120 km reach (dissolved oxygen in mg/L versus distance downstream in km) by including the value of the critical deficit (D_c) in the stream in mg/L and the distance downstream when it occurs in km.