

From equation 8.6, the ultimate BOD is

$$\text{BOD}_u = \frac{204}{1 - 10^{(-0.13)(5)}} = 263 \text{ mg/l}$$

If a sample of industrial wastewater is taken, it will probably lack sufficient microorganisms to metabolize the organic matter. In such a case, seed organisms must be added. The BOD for seeded experiments is found by measuring dissolved oxygen in the seeded sample after 15 minutes (DO_i) and after 5 days (DO_f), as well as the dissolved oxygen of the seed material itself after 15 minutes (DO_i^*) and after 5 days (DO_f^*).

$$\text{BOD}_s = \frac{DO_i - DO_f - x[DO_i^* - DO_f^*]}{\frac{V_{\text{sample}}}{V_{\text{sample}} + V_{\text{dilution}}}} \quad 8.10$$

$$x = \frac{\text{volume of seed added to sample}}{\text{volume of seed used to find } DO^*} \quad 8.11$$

The BOD of domestic waste is typically taken as 0.17 to 0.20 pounds per capita-day, excluding industrial wastes. This makes it possible to calculate the *population equivalent* of any BOD loading.

$$P_e = \frac{\left(\text{BOD} \frac{\text{mg}}{\text{l}}\right) \left(Q \frac{\text{gal}}{\text{day}}\right) \left(8.345 \frac{\text{lbm-l}}{\text{MG-mg}}\right)}{\left(1,000,000 \frac{\text{gal}}{\text{MG}}\right) (1000) \left(0.17 \frac{\text{lbm}}{\text{person-day}}\right)} \quad 8.12$$

(in 1000's of people)

Values of BOD for various industrial wastewaters are given in table 8.2.

BOD of 100 mg/l is considered a *weak wastewater*, BOD of 200 to 250 mg/l is considered a *medium strength wastewater*, above 300 mg/l, it is considered to be a *strong wastewater*.

C. RELATIVE STABILITY

The relative stability test is much easier to perform than the BOD test, although it is much less accurate. The relative stability of an effluent is defined as the percent of initial BOD that has been satisfied. The test consists of taking a sample of effluent and adding a small amount of methylene blue dye. When all oxygen has been removed from the water, anaerobic bacteria start to remove the dye. The time for the color to start degrading is known as the *stabilization time* or *decoloration time*.

The relative stability can be found from the stabilization time by using table 8.3.

Table 8.3
Relative Stability (at 20°C)

stabilization time (days)	relative stability %	stabilization time (days)	relative stability %
1/2	11	8	84
1	21	9	87
1 1/2	30	10	90
2	37	11	92
2 1/2	44	12	94
3	50	13	95
4	60	14	96
5	68	16	97
6	75	18	98
7	80	20	99

Table 8.2
Typical BOD and COD of Industrial Wastewaters

industry/type of waste	BOD	COD
canning		
corn	19.5 lbm/ton corn	
tomatoes	8.4 lbm/ton tomatoes	
dairy milk processing	1150 lbm/ton raw milk	1900 mg/l
	1000 mg/l	
beer brewing	1.2 lbm/barrel beer	
commercial laundry	1250 lbm/1000 pounds dry	2400 mg/l
	700 mg/l	
slaughterhouse	7.7 lbm/animal	2100 mg/l
(meat packing)	1400 mg/l	
papermill	121 lbm/ton pulp	
synthetic textile	1500 mg/l	3300 mg/l
chlorophenolic		
manufacturing	4300 mg/l	5400 mg/l
milk bottling	230 mg/l	420 mg/l
cheese production	3200 mg/l	5600 mg/l
candy production	1600 mg/l	3000 mg/l