Example 3.1

As an example of a mass balance calculation, the experimental data of Dias et al (1981) in Table 3.2 will be analysed. In this experiment a bench scale activated sludge system was utilised and raw sewage was treated at 5 different sludge ages in five sets of experiments (I to V). Table 3.2 shows the results of the daily analyses, reported per set in column I. The OUR was determined for oxidation of carbonaceous material only (nitrification was inhibited by adding allyl-thio urea, a toxic compound for nitrifiers, but not for heterotrophs).

Table 3.2 Experimental results of activated sludge behaviour under steady state conditions

	# of exp.	V_r litre	Q_i l/d^{-1}	q $l.d^{-1}$	S_{ti} $mg.l^{-1}$	S_{te} $mg.l^{-1}$	X_v $mg.l^{-1}$	OUR_c $mg.l^{-1}.h^{-1}$	B_o (-)
I	9	10	16	3.33	730	127	1060	20.3	1.04
II	9	12	16	1.20	691	97	2235	19.6	1.02
III	9	15	16	0.75	780	91	2538	23.6	1.03
IV	14	12	16	0.60	785	155	3012	25.8	1.00
V	20	15	14	0.50	803	77	2686	21.5	0.97

Solution:

Applying Eq. (3.13) for each of the five sets of experiments, the B_o values can be calculated. As an example, for set I one has:

$$B_o = S_{te} + (q/Q \cdot f_{cv} \cdot X_v + R_h \cdot O_c)/S_{ti}$$
$$= (127 + (3.33/16) \cdot 1.5 \cdot 1060 + (10/16) \cdot 20.3 \cdot 24)/730 = 1.04$$

The calculated values for B_O, are in the last column of Table 3.2. It can be noted that in all experiments the B_o values tend towards the theoretical value of 1.00. The weighted average taking into consideration all experiments was $B_O = 1.02$, which means that there is a difference of 2 percent between the experimental and the theoretical value of B_o. As this difference is very small, it is concluded that the experimental data were obtained with the aid of correct procedure.