Text Book Correction–Example 2.14, p. 43

CENG 340–Introduction to Environmental Engineering
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Determination of a Water's Hardness

Water has the following chemical composition: $[Ca^{2+}] = 15$ mg/L; $[Mg^{2+}] = 10$ mg/L,; $[SO_4^{2-}] = 30$ mg/L. What is the total hardness in units of mg/L as $CaCO_3$.

Solution

Find the contribution of hardness from each *divalent cation*. Anions and all nondivalent cations to not contribute to hardness.

$$\frac{15\,mg\,Ca^{2+}}{L} \times \left(\frac{\frac{50\,g\,CaCO_3}{eq}}{\frac{40\,g\,Ca^{2+}}{2eq}} \right) = \frac{38\,mg}{L}\,as\,CaCO_3 \tag{1}$$

$$\frac{10\,mg\,Mg^{2+}}{L} \times \left(\frac{\frac{50\,g\,CaCO_3}{eq}}{\frac{24\,g\,Mg^{2+}}{2eq}} \right) = \frac{42\,mg}{L}\,as\,CaCO_3 \tag{2}$$

Therefore, the total hardness is 38 + 42 = 80 mg/L as $CaCO_3$. This water is moderately hard.

Note that if reduced iron (Fe^{2+}) or manganese (Mn^{2+}) were present they would be included in the hardness calculation.