

The oxygen balance yields

$$2a(16) = 1.2c(16) + 2e(16) + d(16)$$

$$a = 12.427$$

For glucose,

$$\text{amount of carbon in 1 mole of substrate} = 72 \text{ g}$$

$$\text{amount of carbon converted to biomass} = 72(2/3) = 48 \text{ g}$$

Then,  $48 = 4.4c(12)$ ;  $c = 0.909$ .

$$\text{amount of carbon converted to CO}_2 = 72 - 48 = 24 \text{ g}$$

$$24 = 12e; \quad e = 2$$

The nitrogen balance yields

$$14b = 0.86c(14)$$

$$b = 0.782$$

The hydrogen balance is

$$12 + 3b = 7.3c + 2d$$

$$d = 3.854$$

The oxygen balance yields

$$6(16) + 2(16)a = 1.2(16)c + 2(16)e + 16d$$

$$a = 1.473$$

**b.** For hexadecane,

$$Y_{X/S} = \frac{2.42(\text{MW})_{\text{biomass}}}{(\text{MW})_{\text{substrate}}}$$

$$Y_{X/S} = \frac{2.42(91.34)}{226} = 0.98 \text{ gdw cells/g substrate}$$

$$Y_{X/O_2} = \frac{2.42(\text{MW})_{\text{biomass}}}{12.43(\text{MW})_{O_2}}$$

$$Y_{X/O_2} = \frac{2.42(91.34)}{(12.43)(32)} = 0.557 \text{ gdw cells/g O}_2$$

For glucose,

$$Y_{X/S} = \frac{(0.909)(91.34)}{180} = 0.461 \text{ gdw cells/g substrate}$$

$$Y_{X/O_2} = \frac{(0.909)(91.34)}{(1.473)(32)} = 1.76 \text{ gdw cells/g O}_2$$