Problem 6-8

The purchased-equipment cost for a plant which produces pentaerythritol (solid-fluid processing plant) is \$300,000. The plant is to be an addition to an existing formaldehyde plant. The major part of the building cost will be for indoor construction. The contractor's fee will be 7% of the direct plant cost. All other costs are close to the average values found for typical chemical plants. On the basis of this information, estimate the total direct plant cost, the fixed capital investment, and the total capital investment.

Solution:

This solution is based on Example 6-1 and uses the "colorful worksheet." Solve the colorful worksheet first, using cost component factors for solid-fluid processing plants. Adjust the factors to account for indoor construction in an existing plant. Adjust the contractor's fee percentage until the contractors fee is 7% of the direct plant costs.

STINATION OF CAPITAL INVESIMENT BY PERCENTAGE OF DELIVERED EQUIPMENT METHOD		A B	C D	Е	F	G	Н	1	J	K
The fractions in the cells below are approximations applicable to typical chemical processing plants. These values may differ depending on many factors such as location, process type, etc.	1	ESTIMATION OF CAPITAL INVESTMENT BY PERCENTAGE OF DELIVERED EQUIPMENT METHOD								
Plants. These values may differ depending on many factors such as location, process type, etc. Required user input Default Subtotal Result	2	(See Table 6-9)								
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Problem 6-9

Estimate by the turnover ratio method the fixed capital investment required in 2000 for a proposed sulfuric acid plant (battery-limit) which has an annual capacity of 1.3×10^8 kg/yr of 100 percent sulfuric acid (contact catalytic process), using the data form Table 6-11, when the selling price for the sulfuric acid is \$86 per metric ton. The plant will operate 325 days/year. Repeat the calculation, using the cost capacity exponent method with data from Table 6-11.

Solution:

Method 1 - Turnover Ratio

$$Turnover\ Ratio = TOR = \frac{Gross\ Annual\ Sales}{Fixed\ Capital\ Investment} = \frac{G_j}{FCI} = constant$$

From Table 6-11 contains data for the sulfuric acid plant.

$$TOR_{1} = TOR_{2}$$

$$\left(\frac{G_{j}}{FCI}\right)_{1} = \left(\frac{G_{j}}{FCI}\right)_{2}$$

$$\frac{9 \times 10^{7} \frac{kg}{y} \cdot \frac{\$86}{1000kg}}{\$4,000,000} = \frac{1.3 \times 10^{8} \frac{kg}{y} \cdot \frac{\$86}{1000kg}}{FCI}$$

$$FCI = \$5,778,000$$
ANS

Method 2 – Cost capacity exponent method (scaling):

Cost of Plant A = Cost of Plant B
$$\cdot \left(\frac{\text{Capacity of Plant A}}{\text{Capacity of Plant B}}\right)^n$$
Cost of Plant A = \$4,000,000 $\cdot \left(\frac{130,000,000 \text{ kg/yr}}{90,000,000 \text{ kg/yr}}\right)^{0.65} = \$5,080,000 \frac{130,000,000 \text{ kg/yr}}{1000,000 \text{ kg/yr}}$

Problem 6-10

The total capital investment for a chemical plant is \$1 million, and the working capital is \$100,000. If the plant can produce 8000 kg of final product per day during a 365-day year, what selling price in dollars per kilogram of product would be necessary to give a turnover ratio of 1.0?

Solution:

$$TCI = \$1,000,000 \text{ and } WC = \$100,000$$

$$\therefore FCI = TCI - WC = \$1,000,000 - \$100,000 = \$900,000$$

Turnover Ratio = TOR =
$$\frac{Gross\ Annual\ Sales}{Fixed\ Capital\ Investment} = \frac{G_j}{FCI} = 1.0$$

$$\frac{8000 \text{ kg}}{\text{day}} \cdot \frac{365 \text{ days}}{\text{yr}} \cdot \left(x \frac{\$}{\text{kg}}\right) = 1.0$$

Solving for x gives
$$x=$0.308/kg$$
ANS