

Yield Calculation

$$\% \text{ Yield} = \frac{\text{Practical Yield}}{\text{Theoretical Yield}} \times 100$$

- When the yield calculation is made, it should be determined which of the starting substances is the **Basic Substance**.

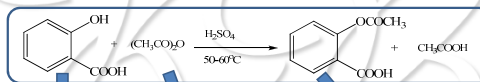
Totally spent (consumed) substance by entering all into the reaction

- After the basic substance is detected, the yield calculation is made on this substance. Because, in order to be able to calculate the yield, the starting substance selected must be completely reacted so that mistakes are prevented.

Keyhan BOLELU, Ph.D

Example 1 (Calculation of yield over weight in aspirin synthesis reaction)

1.3 g salicylic acid and 2 g (1.9 ml) acetic anhydride were reacted to yield 1.6 g aspirin. Calculate the yield of the reaction according to these data.



M.W. = 138.12 g/mole M.W. = 102.09 g/mole M.W. = 180.15 g/mole
 1.3/138.12=0.0094 mole 2/102.09=0.0195 mole 1.6/180.15=0.0089 mole

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Solution

All of 0.0094 mol substance react, so **salicylic acid is basic substance**. Yield calculation is made over this substance.

Calculation of theoretical yield:

From 138.12 g salicylic acid 180.15 g Aspirin is obtained
 From 1.3 g salicylic acid X g Aspirin is obtained

$$X = 1.3 \times 180.15 / 138.12 = 1.69 \text{ g} = \text{Theoretical yield}$$

The amount obtained in practice = 1.6 g = **Practical yield**

1.69 g product %100
 1.6 g product % X

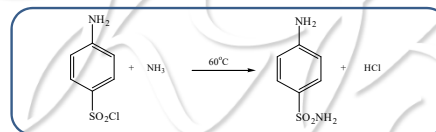
$$X = 1.6 \times 100 / 1.69 = \%94.6$$

Result : In this reaction, aspirin was synthesized with %94.6 yield.

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Example 2 (Calculation of yield over mole in *p*-aminobenzenesulfonamide synthesis reaction)

191.6 g *p*-aminobenzenesulfonyl chloride and 500 ml ammonia were reacted to yield 135.7 g *p*-aminobenzenesulfonamide. Calculate the yield of the reaction according to these data.



p-Aminobenzenesulfonyl chloride *p*-Aminobenzenesulfonamide
 M.W. = 191.69 g M.W. = 172.21 g

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Solution

- p*-Aminobenzenesulfonyl chloride M.W. = 191.69 g 191.6/191.69 = 0.9995 mole
- p*-Aminobenzenesulfonamide M.W. = 172.21 g 135.7/172.21 = 0.7880 mole

$$\% \text{ Yield} = \frac{\text{Practical Yield}}{\text{Theoretical Yield}} \times 100$$

$$\% 78.84 = \frac{0.7880}{0.9995} \times 100$$

Result: In this reaction, *p*-Aminobenzenesulfonamide was synthesized with %78.84 yield.

Keyhan BOLELU, Ph.D