

EXAMPLE PROBLEM WITH WHOLE MILK POWDER AND SOLID FAT

Example Formula: 100 kg mix testing 10% fat, 12% milk solids-not-fat, 8% sucrose, 8% corn syrup solids, 0.25% stabilizer/ emulsifier (38.25% total solids).

Ingredients on hand: Whole Milk Powder (WMP), 26% fat, 71% msnf, 3% moisture; Shortening (or anhydrous milk fat), 100% fat; water; sucrose; corn syrup solids; stabilizer/emulsifier.

Solution, per 100 kg:

1. WMP supplies all of the msnf:

$$12 \text{ kg msnf needed in mix} \times \frac{100 \text{ kg WMP}}{71 \text{ kg msnf}} = 16.9 \text{ kg WMP}$$

2. Find the amount of solid fat needed to supply the rest of the fat, after the fat in WMP has been subtracted out.

$$\text{The WMP contributes: } 16.9 \text{ kg WMP} \times \frac{26 \text{ kg fat}}{100 \text{ kg WMP}} = 4.4 \text{ kg fat}$$

$$\text{Fat source must contribute: } 10 \text{ kg fat total in mix} - 4.4 \text{ kg fat from WMP} = 5.6 \text{ kg}$$

3. Sucrose required will be 8.0 kg/ 100 kg mix.
4. Corn syrup solids required will be 8.0 kg/ 100 kg mix.
5. Stabilizer/ emulsifier required will be 0.25 kg/ 100 kg mix.
6. The amount of water required will be equal to 100 minus the sum of the weights of the other ingredients, thus,

$$100 - (16.9 + 5.6 + 8 + 8 + 0.25) = 61.25 \text{ kg water}$$

Proof

| Ingredients | Kilograms | Kgs. Fat | Kgs. MSNF | Kgs. T.S. |
|--|-----------|----------|-----------|-----------|
| Fat | 5.6 | 5.6 | - | 5.6 |
| Whole Milk powder (26% fat, 71% msnf) | 16.9 | 4.4 | 12.0 | 16.4 |
| Sucrose | 8.0 | - | - | 8.0 |
| Corn Syrup Solids | 8.0 | - | - | 8.0 |
| Stabilizer/ Emulsifier | 0.25 | | | 0.25 |
| Water | 61.55 | - | - | - |
| Totals | 100.0 | 10.0 | 12.0 | 38.25 |

EXAMPLE PROBLEM WITH WHOLE MILK POWDER AND CREAM

Example Formula: 100 kg mix testing 10% fat, 12% milk solids-not-fat, 8% sucrose, 8% corn syrup solids, 0.25% stabilizer/ emulsifier (38.25% total solids).

Ingredients on hand: Whole Milk Powder (WMP), 26% fat, 71% msnf, 3% moisture; Cream, 30% fat, 6.3% msnf; water; sucrose; corn syrup solids; stabilizer/emulsifier.

(Note: if the cream had a different composition, just substitute the correct % of fat and msnf in the equations below)

Solution, per 100 kg:

1. Sucrose required will be 8.0 kg/ 100 kg mix.
2. Corn syrup solids required will be 8.0 kg/ 100 kg mix.
3. Stabilizer/ emulsifier required will be 0.25 kg/ 100 kg mix.
4. Let x =WMP, y =cream, z =water:

Mass Balance (the WMP + cream + water + sucrose + CSS + stab/emul = 100)

$$100 \text{ kg} - 8 - 8 - 0.25 = x + y + z$$

Fat Balance (10% in the mix, coming from 26% of the WMP and 30% of the cream)

$$0.26x + 0.30y = 100 \text{ kg} \times 10\% = 10$$

MSNF balance (12% in the mix, coming from 71% of the WMP and 6.3% of the cream)

$$0.71x + 0.063y = 100 \text{ kg} \times 12\% = 12$$

$$y = \frac{12 - 0.71x}{0.063}$$

From the fat balance,

$$0.26x + 0.3 \left(\frac{12 - 0.71x}{0.063} \right) = 10$$

$$0.26x + 0.3 (190.5 - 11.27x) = 10$$

$$0.26x + 57.15 - 3.38x = 10$$

$$57.15 - 10 = 3.38x - 0.26x$$

$$47.15 = 3.12x$$

$$x = 15.11 \text{ kg WMP}$$

From the MSNF balance,

$$y = \frac{12 - 0.71(15.11)}{0.063} = 1.27/0.063 = 20.16 \text{ kg cream}$$

From the mass balance,

$$100 \text{ kg} - 8 - 8 - 0.25 = x + y + z$$

$$z = 100 - 8 - 8 - 0.25 - 15.11 - 20.16 = 48.48 \text{ kg water}$$

Proof

| Ingredients | Kilograms | Kgs. Fat | Kgs. MSNF | Kgs. T.S. |
|---------------------------------------|-----------|----------|-----------|-----------|
| Cream (30% fat, 6.3% msnf) | 20.16 | 6.1 | 1.3 | 7.4 |
| Whole Milk powder (26% fat, 71% msnf) | 15.11 | 3.9 | 10.7 | 14.6 |
| Sucrose | 8.0 | - | - | 8.0 |
| Corn Syrup Solids | 8.0 | - | - | 8.0 |
| Stabilizer/Emulsifier | 0.25 | | | 0.25 |
| Water | 48.48 | - | - | - |
| Totals | 100.0 | 10.0 | 12.0 | 38.25 |