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.

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

   Fat source must contribute: 10 kg fat total in mix – 4.4 kg fat from WMP = 5.6 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,

   \[100 - (16.9 + 5.6 + 8 + 8 + 0.25) = 61.25 \text{ kg water}\]
<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Kilograms</th>
<th>Kgs. Fat</th>
<th>Kgs. MSNF</th>
<th>Kgs. T.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fat</td>
<td>5.6</td>
<td>5.6</td>
<td>-</td>
<td>5.6</td>
</tr>
<tr>
<td>Whole Milk powder (26% fat, 71% msnf)</td>
<td>16.9</td>
<td>4.4</td>
<td>12.0</td>
<td>16.4</td>
</tr>
<tr>
<td>Sucrose</td>
<td>8.0</td>
<td>-</td>
<td>-</td>
<td>8.0</td>
</tr>
<tr>
<td>Corn Syrup Solids</td>
<td>8.0</td>
<td>-</td>
<td>-</td>
<td>8.0</td>
</tr>
<tr>
<td>Stabilizer/Emulsifier</td>
<td>0.25</td>
<td></td>
<td></td>
<td>0.25</td>
</tr>
<tr>
<td>Water</td>
<td>61.55</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Totals</td>
<td>100.0</td>
<td>10.0</td>
<td>12.0</td>
<td>38.25</td>
</tr>
</tbody>
</table>
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)
   \[100 - 8 - 8 - 0.25 = x + y + z\]
   Fat Balance (10% in the mix, coming from 26% of the WMP and 30% of the cream)
   \[0.26x + 0.30y = 100 \times 10\% = 10\]
   MSNF balance (12% in the mix, coming from 71% of the WMP and 6.3% of the cream)
   \[0.71x + 0.063y = 100 \times 12\% = 12\]
   \[y = \frac{12 - 0.71x}{0.063}\]
   From the fat balance,
   \[0.26x + 0.3 \left(12 - 0.71x\right) \div 0.063 = 10\]
   \[0.26x + 0.3 \left(190.5 - 11.27x\right) = 10\]
\[0.26x + 57.15 - 3.38x = 10\]

\[57.15 - 10 = 3.38x - 0.26x\]

\[47.15 = 3.12x\]

\[x = 15.11 \text{ kg WMP}\]

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**

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