Added Water in Milk from its Freezing Point

Percentage of extraneous water in milk from its freezing point depression compared with authentic milk, with the total solids correction.

Method: Freezing point depression method for extraneous water; Tetra Pak; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Freezing point of authentic milk	-0.52000	°C
Freezing point of the sample	-0.48000	°C
Total solids of the sample	12.000	%

Calculated results

Parameter	Value	Unit
Freezing point depression of authentic milk	520.00	mK
Depression of the sample	480.00	mK
Added water (share of the sample)	6.7692	%
Added water without the solids correction	7.6923	%

Notes for this case

• Milk's freezing point depends on its dissolved lactose and salts and is very constant, about −0.52 °C. Diluting it with water raises the freezing point in proportion: added water = (Δ_r − Δ_s)/Δ_r, applied to the water phase, so it is multiplied by (1 − TS) to express it on the whole sample. Use the reference value set by your national standard; cryoscopes report in °C or in Hortvet degrees (°H), which differ slightly.

Formula and method

$$W_a = \frac{\Delta_r - \Delta_s}{\Delta_r}(1 - TS)$$

Variables

T_r	Freezing point of authentic milk	K
T_s	Freezing point of the sample	K
TS	Total solids of the sample	-
Δ_r	Freezing point depression of authentic milk	K
Δ_s	Depression of the sample	K
W_a	Added water (share of the sample)	-
$W_{a,0}$	Added water without the solids correction	-

Method and standards

Added water.

Assumptions and limits

- Fresh milk; national reference freezing point.

References

Freezing point depression method for extraneous water, Tetra Pak, Dairy Processing Handbook (Tetra Pak Processing Systems, Lund)

Report details

Report reference	FCC-0D2S-ST4D (the same inputs always give the same reference)
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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/chemical/food-dairy/milk-added-water-freezing-point

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Reopens the calculator with the inputs of this report.