Crystalliser Sugar Yield and Exhaustion

Sugar a cubic metre of massecuite yields (Hugot eqns 34.2–34.3), exhaustion of the mother liquor (34.4) and crystal % massecuite (34.5), from brix and purities.

Method: Hugot; Handbook of Cane Sugar Engineering; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Massecuite brix	98.000	%
Massecuite purity	58.000	%
Sugar purity	95.000	%
Molasses purity after crystallisation	35.000	%
Sugar brix	100.00	%
Massecuite density	1,500.0	kg/m³

Calculated results

Parameter	Value	Unit
Sugar per m³ of massecuite	563.50	kg/m³
Exhaustion of sucrose to crystal	61.008	%
Crystal % massecuite brix	35.385	%
Sugar per kg massecuite	37.567	%

Notes for this case

- Hugot's Table 34.2: A 95/85/99/65 gives about 840 kg/m³, B about 660, C about 560.

Formula and method

$$\frac{Q_s}{V_m} = \frac{B_m d_m}{B_s}\frac{P_m - P_e}{P_s - P_e}, \quad \eta = \frac{P_m - P_e}{P_m(1 - P_e)}, \quad x = \frac{P_m - P_e}{1 - P_e}$$

Variables

B_m	Massecuite brix	-
P_m	Massecuite purity	-
P_s	Sugar purity	-
P_e	Molasses purity after crystallisation	-
B_s	Sugar brix	-
d_m	Massecuite density	kg/m³
Q_s/V_m	Sugar per m³ of massecuite	kg/m³
η	Exhaustion of sucrose to crystal	-
x	Crystal % massecuite brix	-
Q_s/Q_m	Sugar per kg massecuite	-

Method and standards

Hugot's crystallisation balances.

Assumptions and limits

- Pure crystals in x; impure sugar in Q_s.
- The balances hold on any one purity basis, apparent (pol) or true (sucrose), provided massecuite, sugar and molasses are all on it; the yields are then on that basis.

References

• Hugot
• Handbook of Cane Sugar Engineering
• 3rd ed. (Elsevier, 1986)
• ch. 34
• eqns 34.1–34.5 and Table 34.2
• pp. 725–727

Report details

Report reference	FCC-V23P-H1DX (the same inputs always give the same reference)
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Release checks	2 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/sugar-ethanol/pan-boiling/crystalliser-sugar-yield

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.