Maximal Imbibition a Final Mill Can Take (Hugot)

Highest imbibition on fibre a final mill takes without choking from water temperature, specific pressure, speed and specific fibre loading (Hugot eqn 19.21).

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Crushing rate	130.00	t/h
Fibre % cane	12.500	%
Peripheral speed of the final mill	12.500	m/min
Roller diameter	0.81200	m
Roller length	1.6760	m
Imbibition water temperature	60.000	°C
Specific hydraulic pressure of the final mill	25.000	t/dm²

Calculated results

Parameter	Value	Unit
Specific fibre loading	15.921	kg/m³
Maximal imbibition on fibre	147.38	%
Maximal imbibition water	23.949	t/h

Notes for this case

- Russell: no more than about 3.6 times the fibre at one mill; split heavier imbibition over two mills.
- The regression comes from one set of mills; outside their conditions treat it as a rough guide.

Formula and method

$$\lambda_M = 554 - 0.9\,t - 5\,p + 20\,v - 30\,\tau \quad [\%\ \text{on fibre};\ t\ ^\circ\text{C};\ p\ \text{t/dm}^2;\ v\ \text{m/min};\ \tau\ \text{kg/m}^3]$$

$$\tau = \frac{A f}{v D L}$$

Variables

A	Crushing rate	kg/s
f	Fibre % cane	-
v	Peripheral speed of the final mill	m/s
D	Roller diameter	m
L	Roller length	m
t	Imbibition water temperature	K
p	Specific hydraulic pressure of the final mill	Pa
τ	Specific fibre loading	kg/m³
λ_M	Maximal imbibition on fibre	-
W_M	Maximal imbibition water	kg/s

Method and standards

Hugot eqn 19.21 (Handbook of Cane Sugar Engineering, 3rd ed., pp. 310–311), which Hugot built from two results of Haines and Hughes's regression for the final mill at Puunene, Hawaii. Hugot gives no range of validity; his worked example is a 812 × 1676 mm mill at 130 t cane/h, 12.5 % fibre, 25 t/dm², 12.5 m/min and 60 °C, giving 145 % imbibition on fibre.

Assumptions and limits

- Regression from one set of mills; use as a guide. Their range of pressures, speeds and temperatures is not stated with the formula, so results far from Hugot's example (25 t/dm², 12.5 m/min, 60 °C) are extrapolations.
- A note compares λ_M with Russell's limit of about 3.6 times the fibre.

References

- Hugot
- Handbook of Cane Sugar Engineering
- 3rd ed. (Elsevier, 1986)
- ch. 19
- eqn 19.21 (after Haines and Hughes)
- pp. 310–311

Report details

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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/milling/maximal-imbibition

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Reopens the calculator with the inputs of this report.