Diffuser Percolation Rate and Juice Circulation

Juice circulated through a diffuser bed from the percolation rate and bed area, the circulation per tonne cane and the time for juice to pass the bed (Hugot ch. 23).

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Crushing rate	250.00	t/h
Diffuser width	6.5000	m
Length of bed under percolation	45.000	m
Percolation rate Hugot: de Smet bagasse 14–25 m³/(m²·h), about 17–18; cane 7–15, about 12.	17.000	m/h
Bed depth	1.8000	m
Juice density	1,050.0	kg/m³

Calculated results

Parameter	Value	Unit
Juice circulated	4,972.5	m³/h
Circulation per tonne cane	20.884	kg/kg
Time for juice to cross the bed	6.3529	min

Notes for this case

- Hugot: heating water 5–10 times the bagasse weight in bagasse diffusers, 4–5 times the cane in cane diffusers.

Formula and method

$$\dot{V} = u\,L\,Z, \quad \frac{\dot{m}_J}{A} = \frac{\rho_J \dot{V}}{A}, \quad t_p = \frac{H}{u}$$

Variables

A	Crushing rate	kg/s
L	Diffuser width	m
Z	Length of bed under percolation	m
u	Percolation rate	m/s
H	Bed depth	m
ρ_J	Juice density	kg/m³
$\dot{V}$	Juice circulated	m³/s
$\dot{m}_J/A$	Circulation per tonne cane	kg/kg
t_p	Time for juice to cross the bed	s

Method and standards

Continuity over the bed area.

Assumptions and limits

- Uniform percolation over the area.
- The crossing time uses the superficial percolation rate; the juice moves faster in the voids of the bed, so the time is an upper estimate.
- Hugot's heating-water multiples in the note are for comparison only; they are not checked against the computed circulation.

References

- Hugot
- Handbook of Cane Sugar Engineering
- 3rd ed. (Elsevier, 1986)
- ch. 23
- percolation and recirculation
- pp. 373–391

Report details

Report reference	FCC-SPYW-1X3N (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/diffusion/diffuser-percolation

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.