H-Factor of a Kraft Cook (Ramp and Hold)

H-factor of a kraft cook with a linear temperature ramp and a hold, by Vroom's relative rate (1 at 100 °C), and the hold time for a target H-factor.

Method: Smook; Handbook for Pulp & Paper Technologists; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Start temperature of the ramp	80.000	°C
Cooking temperature	170.00	°C
Ramp time	90.000	min
Hold time at T_c	90.000	min
Target H-factor	1,500.0	

Calculated results

Parameter	Value	Unit
Relative rate at cooking temperature	916.76	
H-factor of the ramp	176.73	
H-factor of the hold	1,375.1	
Total H-factor	1,551.9	
Hold time for the target H-factor	86.605	min

Notes for this case

- Equal H-factors give about equal kappa numbers for the same wood and alkali charge; adjust hold time, not temperature, for small corrections.

Formula and method

$$k(T) = \exp\left(43.181 - \frac{16\,113}{T}\right), \quad H = \int k\,dt \ (t \text{ in hours})$$

Variables

T_0	Start temperature of the ramp	K
T_c	Cooking temperature	K
t_r	Ramp time	s
t_h	Hold time at T_c	s
H^*	Target H-factor	-
$k(T_c)$	Relative rate at cooking temperature	-
H_r	H-factor of the ramp	-
H_h	H-factor of the hold	-
H	Total H-factor	-
t_h^*	Hold time for the target H-factor	s

Method and standards

Vroom's H-factor; ramp integrated by Simpson's rule.

Assumptions and limits

- Linear ramp; uniform temperature.

References

- Smook
- Handbook for Pulp & Paper Technologists
- 3rd ed. (Angus Wilde, 2002)
- ch. 7 (H-factor: relative reaction rate 1 at 100 °C, area under the rate–time curve)
- Vroom
- Pulp Paper Mag. Can. 58(3): 228 (1957): ln k = 43.181 − 16 113/T

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/chemical/pulp-paper/h-factor-kraft-cook

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.