Kraft Cook: Alkali Charge and Liquor-to-Wood Ratio

White and black liquor volumes and liquor-to-wood ratio for a kraft cook from wood, chip moisture, alkali charge on wood and liquor strength (Smook ch. 7).

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Wood charged (oven-dry)	50,000	kg
Chip moisture (wet basis)	45.000	%
Effective alkali charge on OD wood (as Na_2O)	15.000	%
White liquor effective alkali (as Na_2O)	100.00	g/L
Target liquor-to-wood ratio Volume ratio: m³ of total liquor per OD tonne of wood (= L/kg). For a mass ratio in t/t, divide it by the liquor density in t/m³ first.	4.0000	

Calculated results

Parameter	Value	Unit
Effective alkali required	7,500.0	kg
White liquor volume	75.000	m³
Water in the chips	40.909	m³
Black liquor (or water) to make up the ratio	84.091	m³

Formula and method

$$EA = EA\% \times W, \quad V_{WL} = \frac{EA}{c_{WL}}, \quad V_{chip} = \frac{W m_c}{(1 - m_c)\rho_w}, \quad V_{BL} = (L/W)\,W - V_{WL} - V_{chip}$$

Variables

W	Wood charged (oven-dry)	kg
m_c	Chip moisture (wet basis)	-
$EA\%$	Effective alkali charge on OD wood (as Na_2O)	-
c_{WL}	White liquor effective alkali (as Na_2O)	kg/m³
L/W	Target liquor-to-wood ratio	-
EA	Effective alkali required	kg
V_{WL}	White liquor volume	m³
V_{chip}	Water in the chips	m³
V_{BL}	Black liquor (or water) to make up the ratio	m³

Method and standards

Mass balance of the digester charge.

Assumptions and limits

- Water density 1 000 kg/m³; liquor volumes additive.
- The liquor-to-wood ratio is a volume ratio (m³ per OD tonne). A ratio specified by mass (t/t) must be converted with the liquor density, or the black liquor make-up is off by 10–20 %.

References

• Smook
• Handbook for Pulp & Paper Technologists
• 3rd ed. (Angus Wilde, 2002)

- ch. 7 (kraft pulping: alkali charge on wood and liquor-to-wood ratio)

Report details

Report reference	FCC-EP54-JNAE (the same inputs always give the same reference)
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Calculator	Kraft Cook: Alkali Charge and Liquor-to-Wood Ratio
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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/kraft-alkali-charge

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.