Green Liquor Reduction Efficiency and Causticizing Efficiency

Reduction efficiency from green liquor Na_2S and Na_2SO_4, and causticizing efficiency from white liquor NaOH, Na_2CO_3 and green liquor NaOH (Smook).

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Green liquor Na_2S (as Na_2O)	30.000	g/L
Green liquor Na_2SO_4 (as Na_2O)	2.5000	g/L
Green liquor NaOH (as Na_2O)	10.000	g/L
White liquor NaOH (as Na_2O)	85.000	g/L
White liquor Na_2CO_3 (as Na_2O)	20.000	g/L

Calculated results

Parameter	Value	Unit
Reduction efficiency	92.308	%
Causticizing efficiency	78.947	%
Causticity (green liquor NaOH included)	80.952	%

Notes for this case

- Reduction efficiency above 90–95 % is normal; low values mean dead load of sulphate in the liquor cycle.

Formula and method

$$RE = \frac{Na_2S}{Na_2S + Na_2SO_4}, \quad CE = \frac{NaOH_{WL} - NaOH_{GL}}{(NaOH_{WL} - NaOH_{GL}) + Na_2CO_3}$$

Variables

Na_2S_{GL}	Green liquor Na_2S (as Na_2O)	kg/m³
Na_2SO_4	Green liquor Na_2SO_4 (as Na_2O)	kg/m³
$NaOH_{GL}$	Green liquor NaOH (as Na_2O)	kg/m³
$NaOH_{WL}$	White liquor NaOH (as Na_2O)	kg/m³
Na_2CO_3	White liquor Na_2CO_3 (as Na_2O)	kg/m³
RE	Reduction efficiency	-
CE	Causticizing efficiency	-
$\mathrm{causticity}$	Causticity (green liquor NaOH included)	-

Method and standards

Smook's definitions (simplified reduction efficiency).

Assumptions and limits

- All as Na_2O; sulphite and thiosulphate ignored.
- Green liquor NaOH is subtracted from white liquor NaOH directly, which assumes no dilution between them; weak wash and lime mud water dilute the white liquor, so put both analyses on the same basis (for example per unit of total titratable alkali) first.
- White liquor NaOH not above the green liquor NaOH is rejected.

References

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

- ch. 7
- Table 7-1 (definitions 8 and 10)
- ch. 10 (causticizing)

Report details

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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/green-liquor-reduction-causticizing

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Reopens the calculator with the inputs of this report.