Kiln Gas Bypass: Alkali Circulation and Reduction

Alkali circulation in a preheater kiln and the reduction of K2O or Na2O in clinker for a gas bypass fraction, from the volatility factors (Weber's method).

Method: Duda; Cement Data Book; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Volatility of the raw-mix alkali	60.000	%
Volatility of the circulating alkali	90.000	%
Bypass (fraction of kiln gas and alkali not condensed in the preheater)	25.000	%
Alkali in clinker without bypass	1.2500	%

Calculated results

Parameter	Value	Unit
Circulating alkali (per unit input)	1.3846	
Alkali reduction in clinker	46.154	%
Alkali in clinker with bypass	0.67308	%

Notes for this case

• Typical factors (Duda Table 20.2): K_2O ε_1 0.4–0.6 (0.6–0.8 with chloride), ε_2 0.9; Na_2O ε_1 0.25–0.4 (0.5–0.6), ε_2 0.8. Calculate K_2O and Na_2O separately. A bypass also removes heat and dust: each per cent costs fuel.

Formula and method

$$K-1=\frac{\varepsilon_1(1-V)}{1-\varepsilon_2(1-V)},\quad \Delta A=(K-1)\frac{V}{1-V}$$

Variables

ε_1	Volatility of the raw-mix alkali	-
ε_2	Volatility of the circulating alkali	-
V	Bypass (fraction of kiln gas and alkali not condensed in the preheater)	-
A_0	Alkali in clinker without bypass	-
$K-1$	Circulating alkali (per unit input)	-
ΔA	Alkali reduction in clinker	-
A	Alkali in clinker with bypass	-

Method and standards

Weber's alkali balance.

Assumptions and limits

- Alkali in fuel neglected.

References

• Duda
• Cement Data Book
• Vol. 1
• 3rd ed. (Bauverlag / Macdonald and Evans, 1985)
• sec. 20.6.4 (Weber's method) and Table 20.2

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/cement/kiln-alkali-bypass

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.