Chlorine Dioxide By-Product Chlorite: Formation and Ferrous Iron Dose

Chlorite formed from a chlorine dioxide dose and the ferrous iron needed to reduce it to chloride (4 mol Fe^{2+} per mol ClO_2^-), with the iron per mg chlorite.

Method: Stoichiometry $4Fe^{2+} + ClO_2^- \rightarrow 4Fe^{3+} + Cl^-$

Input parameters

Unit system: SI

Parameter	Value	Unit
Chlorine dioxide dose	1.5000	mg/L
Share of the dose that becomes chlorite	65.000	%
Chlorite allowed after treatment	0.20000	mg/L
Excess ferrous iron over stoichiometric	20.000	%

Calculated results

Parameter	Value	Unit
Chlorite formed	0.97500	mg/L
Chlorite to remove	0.77500	mg/L
Stoichiometric iron per chlorite, mg/mg	3.3117	
Ferrous iron dose	3.0799	mg/L
As ferrous sulphate heptahydrate	15.332	mg/L

Notes for this case

• $4Fe^{2+} + ClO_2^- + 2H_2O$? $4Fe^{3+} + Cl^- + 4OH^-$ (after hydrolysis $10H_2O$ gives $4Fe(OH)_3 + 8H^+$). Typically 50–70 % of chlorine dioxide applied ends as chlorite; the ferric hydroxide formed must be removed by the following clarification and filtration.

Formula and method

$$C_{ClO_2^-} = f C_{ClO_2}, \quad C_{Fe} = (C_{ClO_2^-} - C_{target}) \frac{4M_{Fe}}{M_{ClO_2^-}} (1 + \chi)$$

Variables

C_{ClO_2}	Chlorine dioxide dose	kg/m³
f	Share of the dose that becomes chlorite	-
C_{target}	Chlorite allowed after treatment	kg/m³
χ	Excess ferrous iron over stoichiometric	-
$C_{ClO_2^-}$	Chlorite formed	kg/m³
ΔC	Chlorite to remove	kg/m³
Fe/ClO_2^-	Stoichiometric iron per chlorite, mg/mg	-
C_{Fe}	Ferrous iron dose	kg/m³
$C_{FeSO_4 \cdot 7H_2O}$	As ferrous sulphate heptahydrate	kg/m³

Method and standards

Reduction of chlorite by ferrous iron.

Assumptions and limits

- Stoichiometric reaction; pH 5–7 for fast reaction.

References

Stoichiometry $4Fe^{2+} + ClO_2^- \rightarrow 4Fe^{3+} + Cl^-$

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/environmental/drinking-water/chlorite-removal-ferrous-dose

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Reopens the calculator with the inputs of this report.