A3 Pyrites Roasting

Inputs		Amount	Unit	Comments
	SO_2	8-10	%	slightly variable over time
	O_2	8-11	%	
	CO_2	0	%	
	H_2O	0	%	
Outputs				
	Energy	~4,500	$MJ.t^{-1}$ ***	net balance incl. roasting process
	Emissions into air			
	SO_2 *	3.0	$kg.t^{-1}$ ***	
	SO_3 *	0.2	$kg.t^{-1}$ ***	
	H_2SO_4 *	n.a.	$kg.t^{-1}$ ***	
	NO_x **	~210	$mg.Nm^{-3}$	
	CO_2	0	%(vol)	
	Emissions into water			no emission into water
	Solid emissions	~40	$g.t^{-1}$ ***	spent catalyst
	Conversion rate	99.4-99.6	%	
	Emission with the final product			dependent of the analyses of the pyrites
	As	0.01	ppm	The figures are examples from one specific pyrite, see 2.1.2.1.
	Hg	0.03	ppm	
	Se	0.05	ppm	
	F	n.a.	ppm	
	SO_2	13	ppm	
	NO_x	n.a.	ppm	
	HCl	n.a.	ppm	
	Organic carbon	0	ppm	

* : expressed as SO_2
** : expressed as NO_2
*** : in $kg.t^{-1}$ 100% sulphuric acid

A4 Zn, Pb Smelter Sulphuric Acid Plants

Inputs		single Abs.		double Abs.	
	% SO_2	4 ~ 6		5 ~ 9	
	% O_2	6 ~ 12		6 ~ 11	
	% CO_2	x		x	
	% H_2O	x		x	
	variability in time	low		low	
	Energy $MJ.t^{-1}.H_2SO_4$			~ 600	
Outputs	Air emission at stack	$kg.t^{-1}$ H_2SO_4	$mg.NO_x.Nm^{-3}$	$kg.t^{-1}$ H_2SO_4	$mg.NO_x.Nm^{-3}$
	SO_2	7 ~ 12	x	1.7 ~ 3.3	x
	SO_3	0.1 ~ 0.2	x	0.05 ~ 0.08	x
	NO_x		150		150
	H_2SO_4	0.05 ~ 0.1	x	0.05 ~ 0.08	x
	Conversion SO_2/SO_3	98 ~ 99%		99.5 ~ 99.7%	
	H_2O emission	no contaminants		no contaminants	
	Spent Catalyst	20 ~ 40g.t^{-1}.H_2SO_4 to recycle in process		20 ~ 40g.t^{-1}.H_2SO_4 to recycle in process	
	H_2SO_4				
	Hg	max 1ppm			
	As	max 0.5ppm			
	Se	max 0.2ppm			
	SO_2	< 50ppm			
	NO_2	5~30ppm			
	Org C	max 1ppm			
	Energy steam in Roasting Process $MJ.t^{-1}.H_2SO_4$	3,500			
	(waste) heat in acid production:- $MJ.t^{-1}.H_2SO_4$	1,000 ~ 2,000			
	Net Balance (In-Out)	3,900 ~ 4,900			

A5 Complex (Pb, Cu) S Batch Treatment

Inputs		single Abs.		double Abs.	
	% SO_2	2.70% on dry			
	% O_2	2.50% on dry			
	% CO_2	20.00% on dry			
	% H_2O	45%			
	variability in time	extremely			
	Energy $MJ.t^{-1}.H_2SO_4$	900			
Outputs	Air emission at stack	$kg.t^{-1}$ H_2SO_4	$mg.NO_2.Nm^{-3}$	$kg.t^{-1}$ H_2SO_4	$mg.NO_2.Nm^{-3}$
	SO_2	6 ~ 10			x
	SO_3	see H_2SO_4			x
	NO_2		100		
	H_2SO_4	0.15			x
	Conversion SO_2/SO_3	99.0-99.2%			
	H_2O emission	none			
	Spent Catalyst	20 ~ 40 $g.t^{-1}.H_2SO_4$			
	H_2SO_4				
	Hg	<1ppm			
	As	<0.2ppm			
	Se	<0.5ppm			
	SO_2	90ppm			
	NO_2	150ppm			
	Org C	40ppm			
	Energy steam in Roasting Process $MJ.t^{-1}.H_2SO_4$	depending on S-content			
	(waste) heat in acid production:- $MJ.t^{-1}.H_2SO_4$	1,000 ~ 2,000			
	Net Balance (In-Out)	~1,000-2,000			

product stewardship
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Best Available Techniques Booklets were first issued by Fertilizers Europe in 1995. Second revised edition 2000.

1. Production of Ammonia
2. Production of Nitric Acid
3. Production of Sulphuric Acid (in collaboration with ESA)
4. Production of Phosphoric Acid
5. Production of Urea and Urea-Ammonium Nitrate
6. Production of Ammonium Nitrate and Calcium Ammonium Nitrate
7. Production of NPK Compound Fertilizers by Nitrophosphate Route
8. Production of NPK Compound Fertilizers by Mixed Acid Route

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