Salt Partners

Upgrading and refining of salt for chemical and human consumption

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Salt production world-wide

Salt type	World production
Solar salt	80,000,000 t/y
Rock salt	60,000,000 t/y
Brines	70,000,000 t/y
Total	210,000,000 t/y

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Salt consumption world-wide

Salt user	Salt consumption
Chemical industry	80,000,000 t/y
Food	60,000,000 t/y
Other	70,000,000 t/y

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Impurities in salt

	Rock salt	Sea salt	Lake salt	Brines
$CaSO_4$	0.5 – 2%	0.5 – 1%	0.5 – 2%	Saturated
$MgSO_4$	Traces	0.2 – 0.6%	Traces	Traces
$MgCl_2$		0.3 – 1%	Traces	
$CaCl_2$			Traces	
Na_2SO_4			Traces	
KCl			Traces	
NaBr			Traces	
Insolubles	1 – 30%	0.1 – 1%	1 – 10%	

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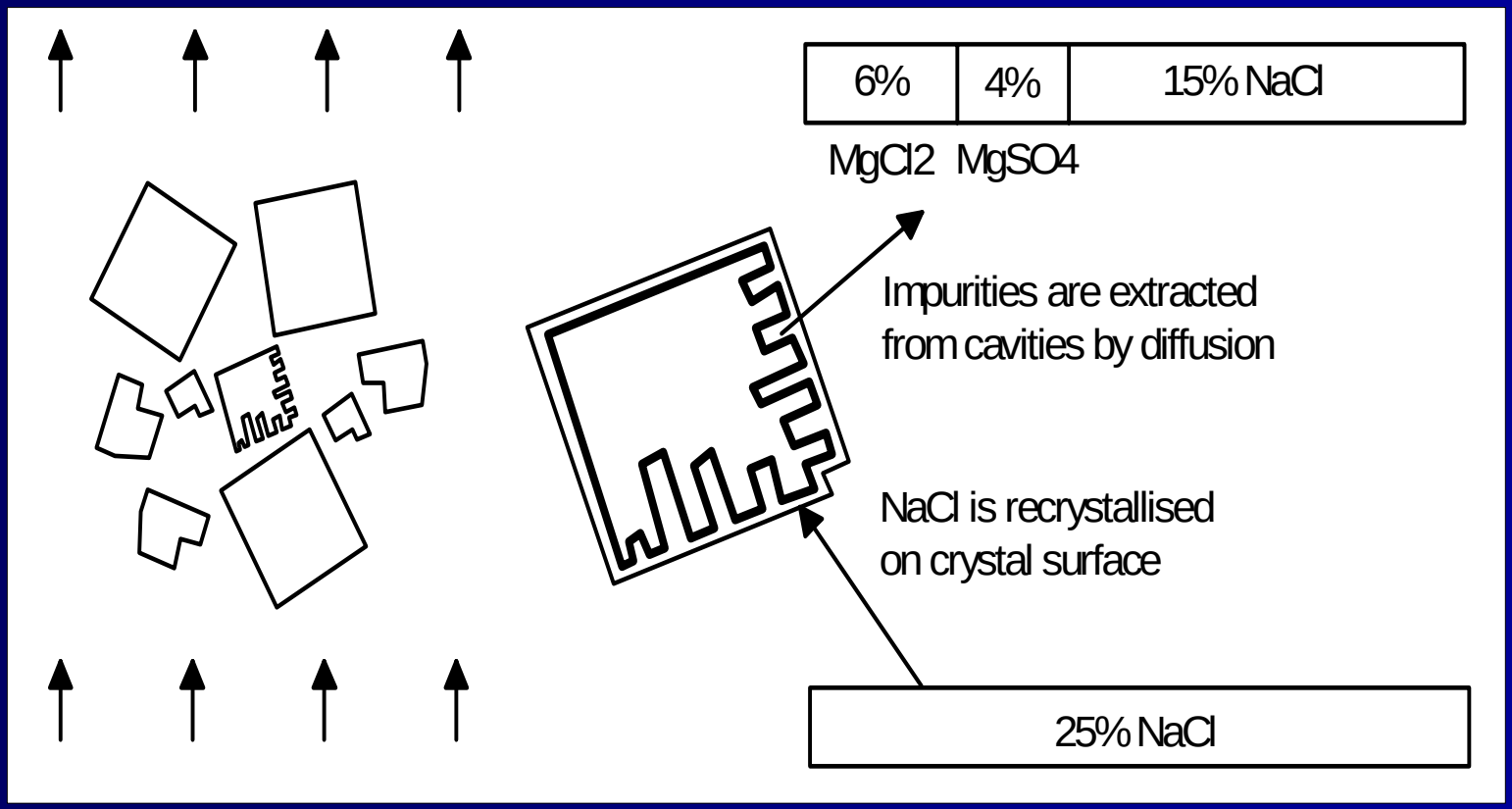
Hydroextraction



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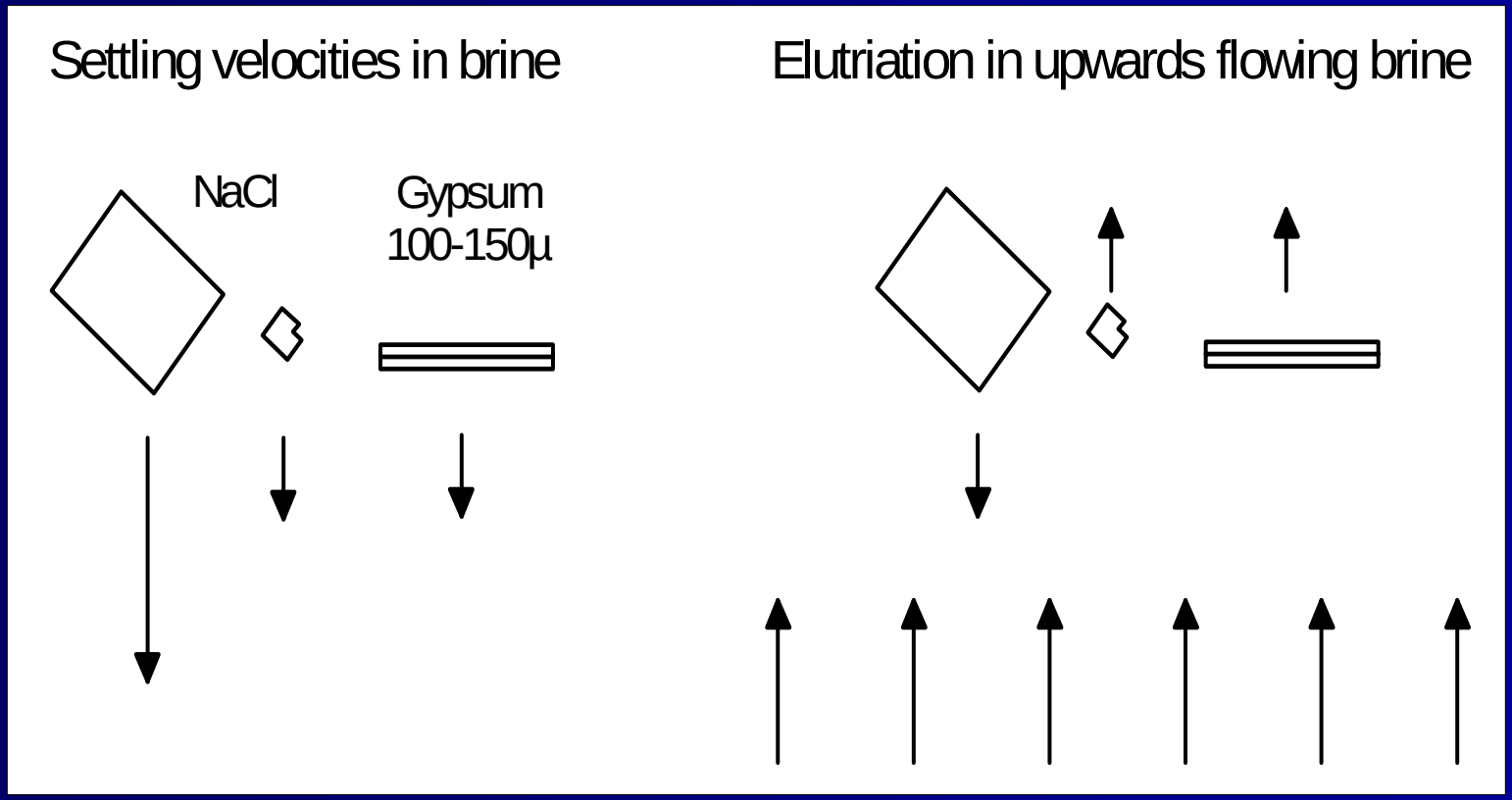
Elutriation



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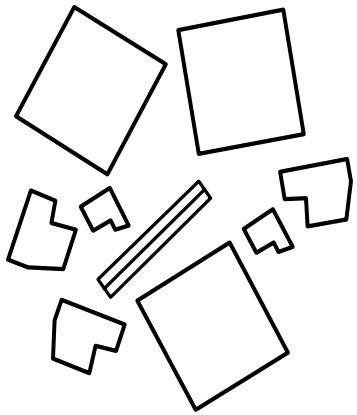
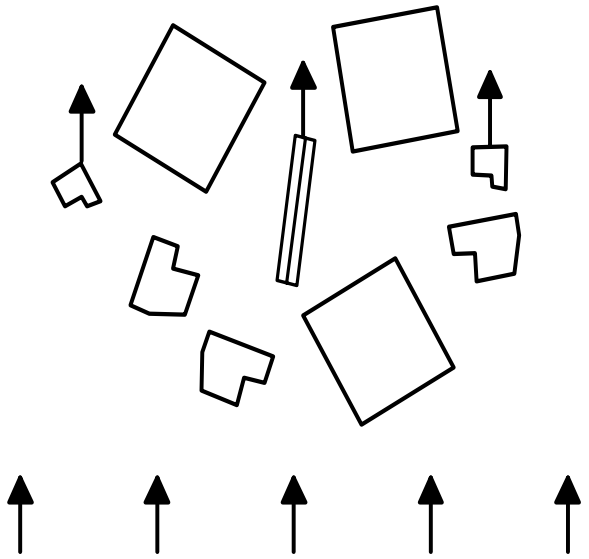
Hydroclassification

Salt bed with buried impurities



Hydroclassification of impurities in partially fluidised salt bed



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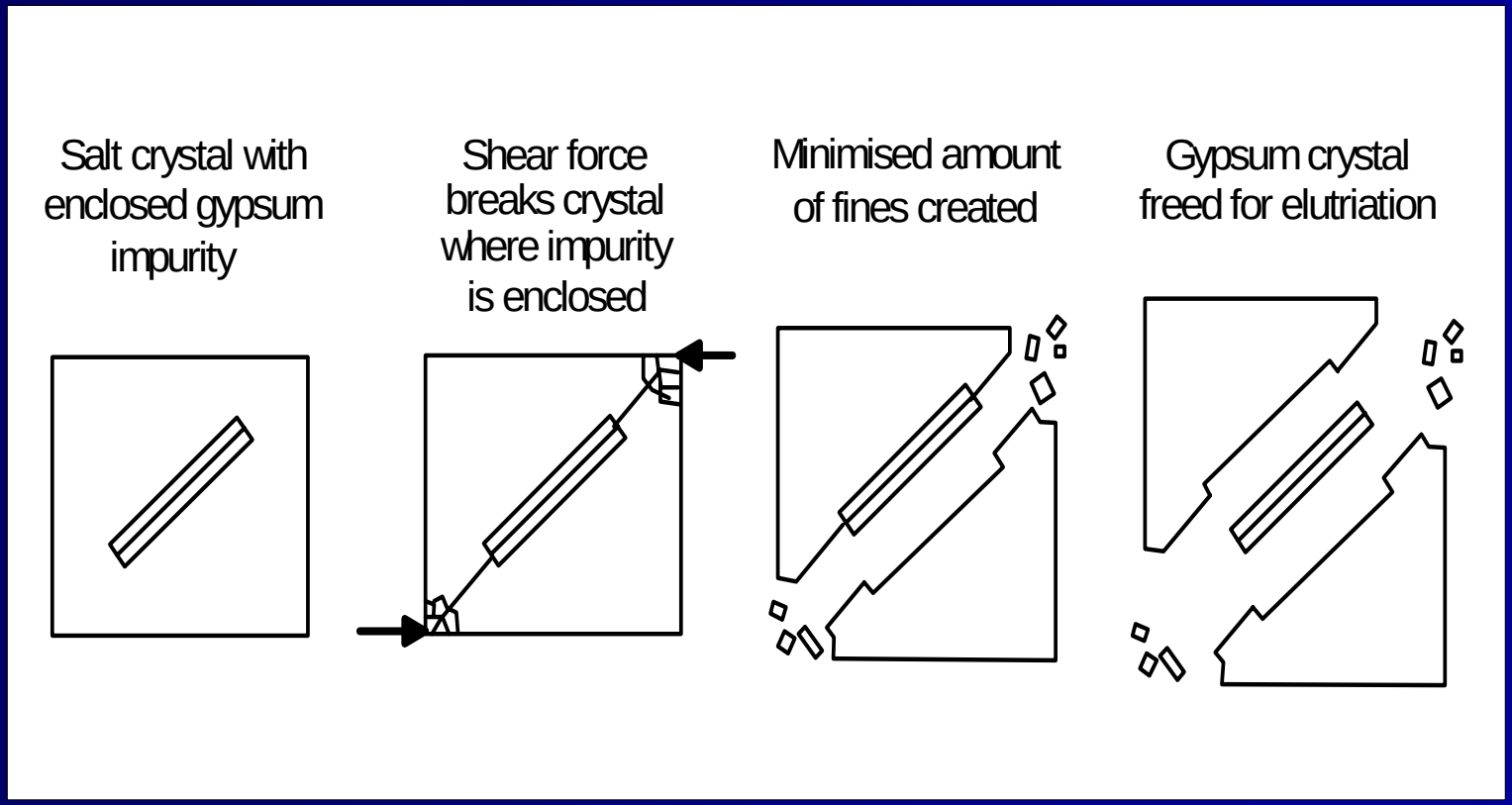
Hydromilling and shear crushing



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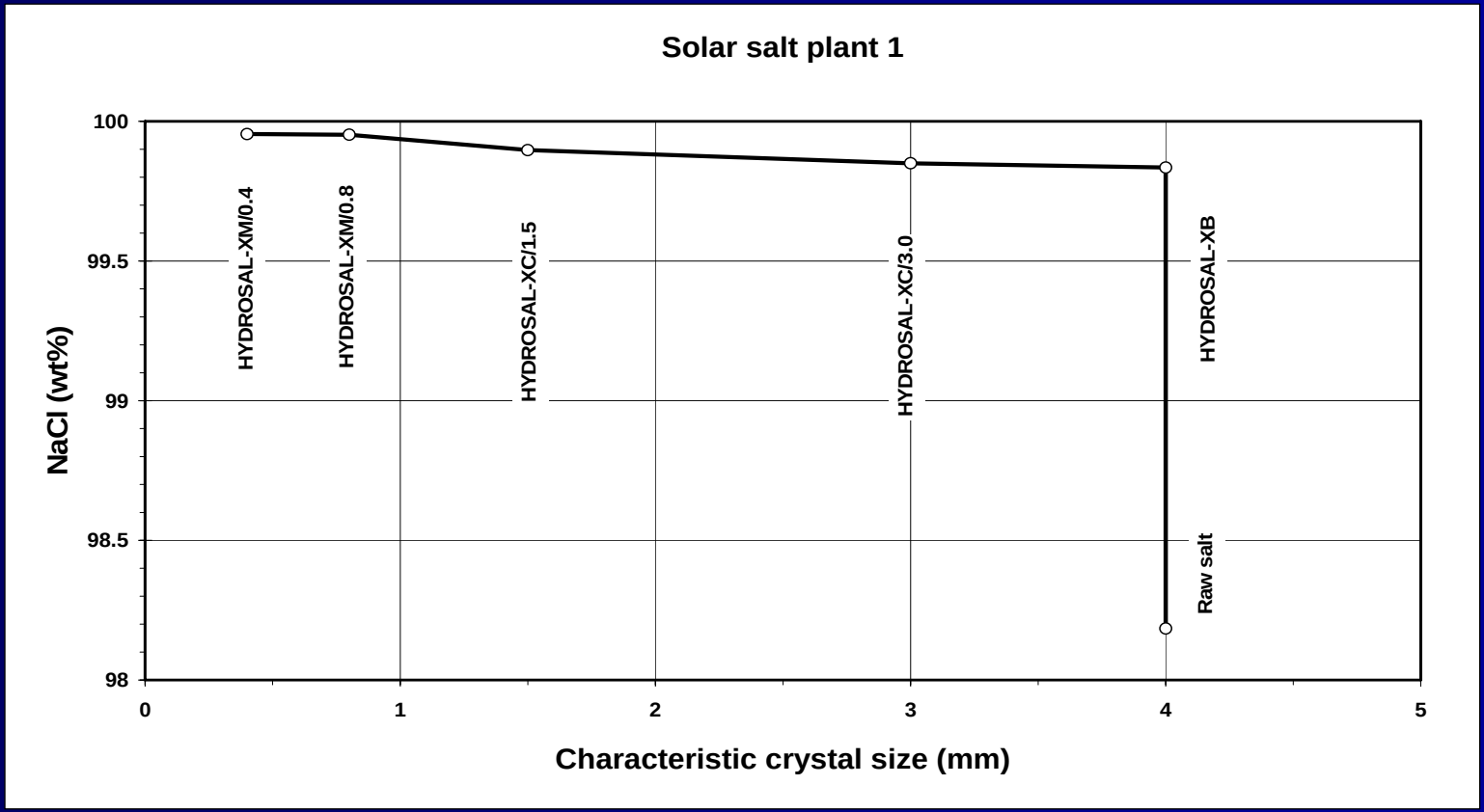
Salt upgradability test, NaCl content



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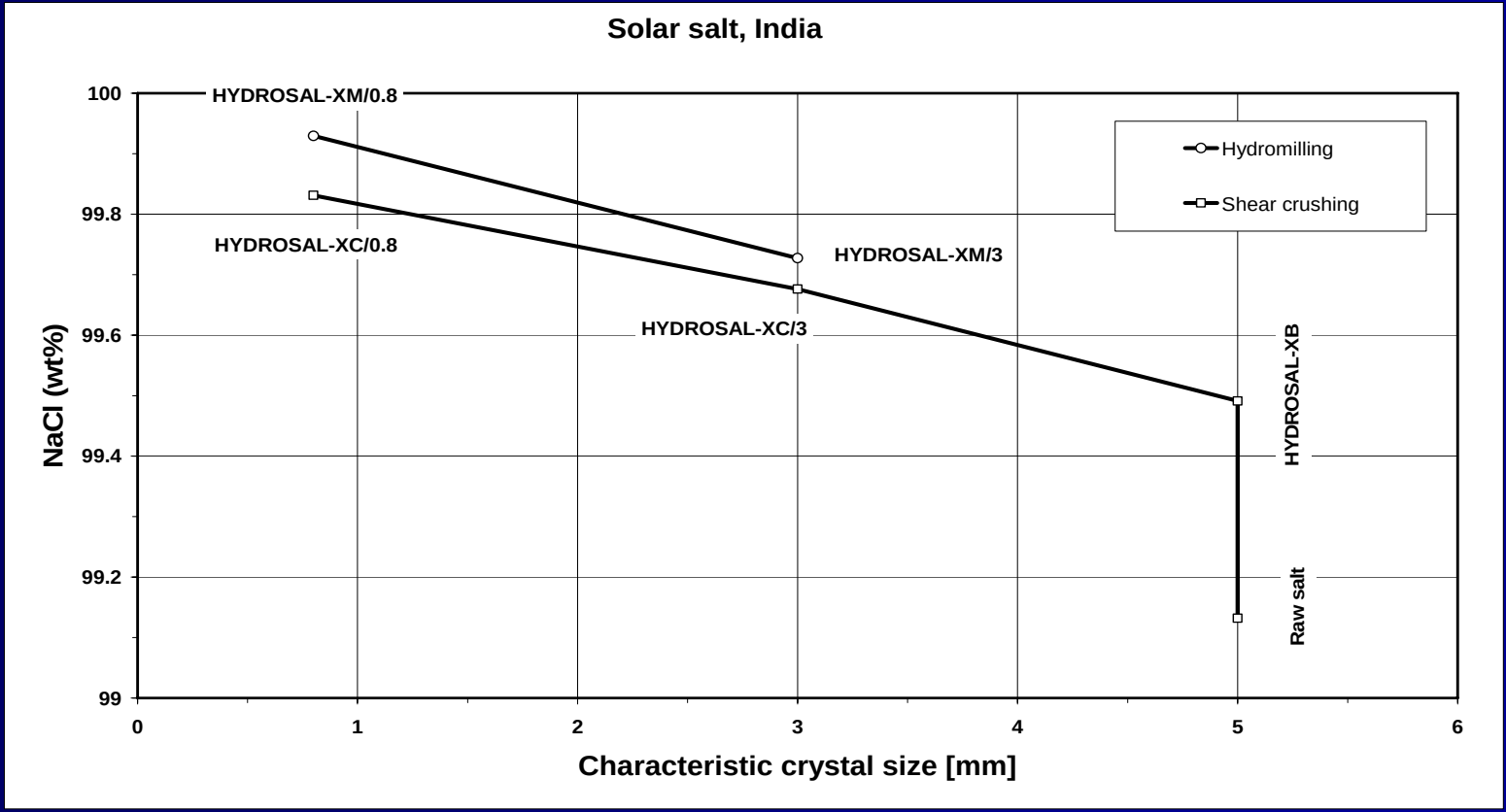
Salt upgradability test, NaCl content



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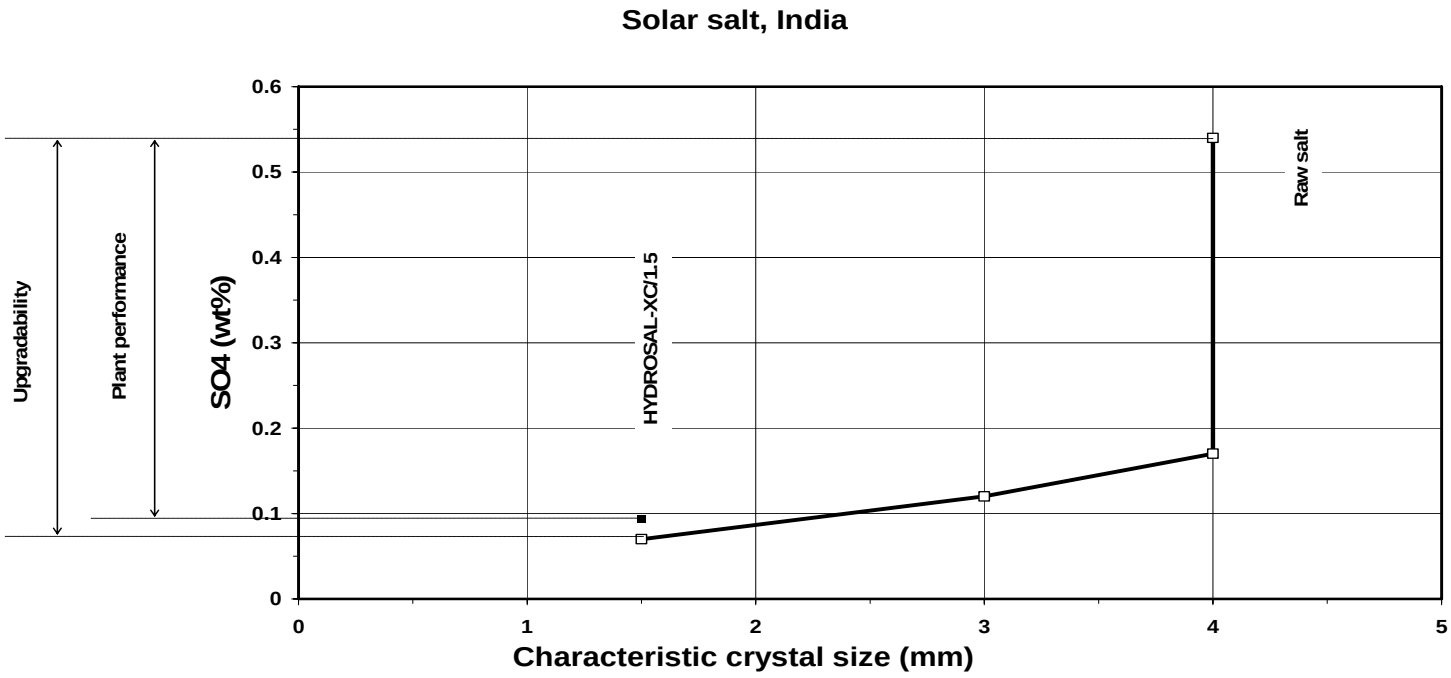
Plant efficiency calculation, sulphate



$$\text{Efficiency} = \frac{\text{Plant performance}}{\text{Upgradability}} = \frac{0.54 - 0.094}{0.54 - 0.070} = 95\ \%$$

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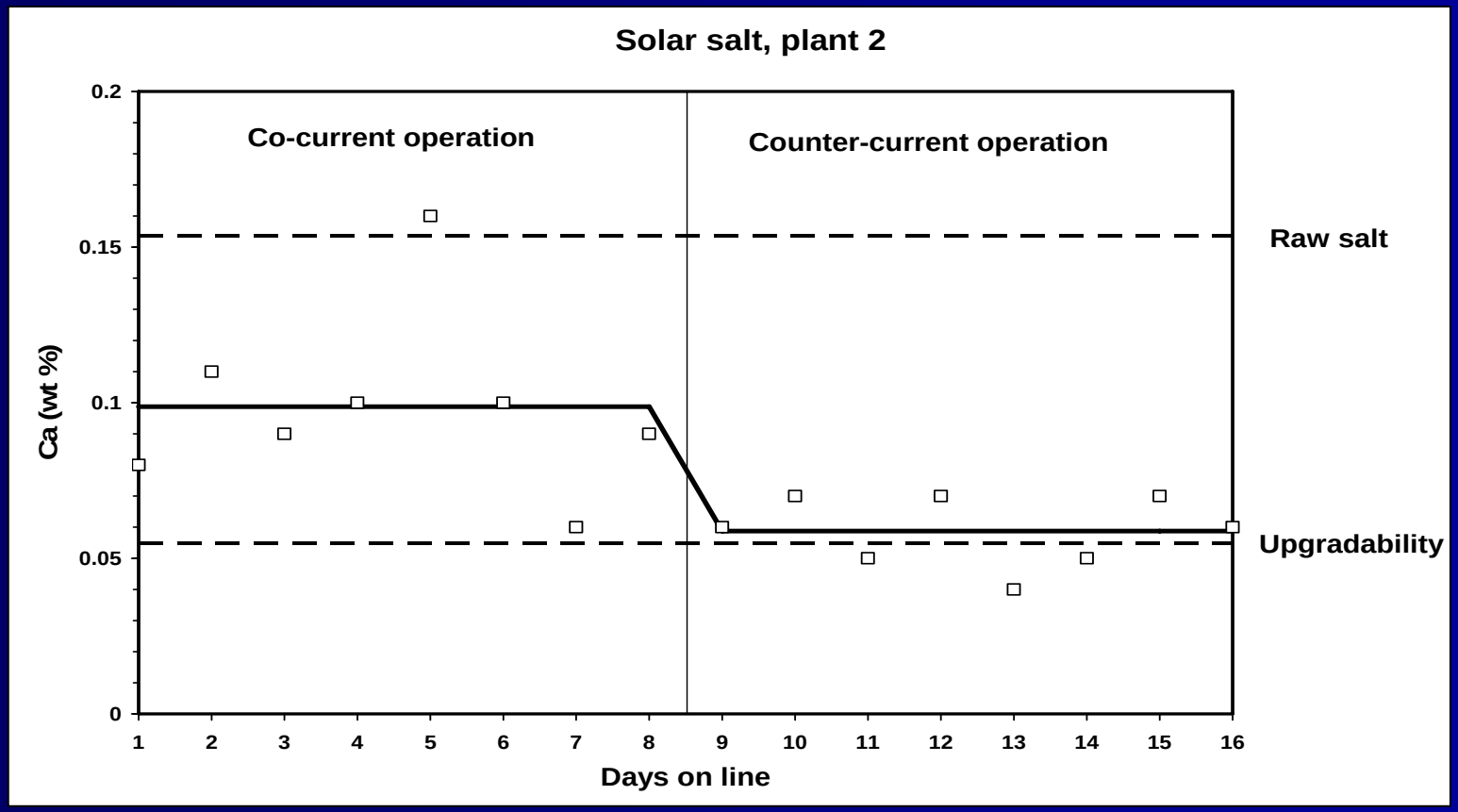
Co-current vs. counter-current process performance



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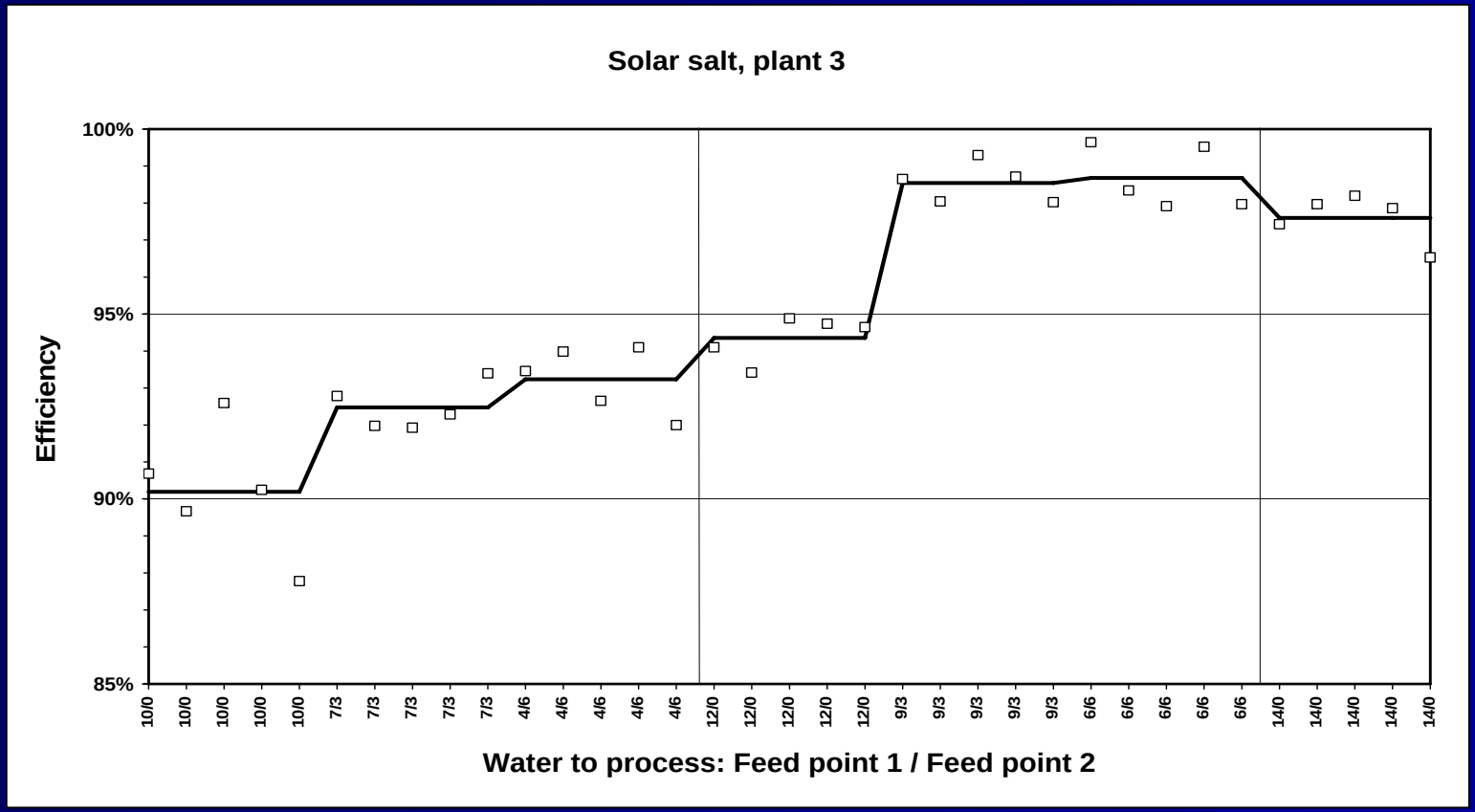
HYDROSAL optimisation test, NaCl efficiencies



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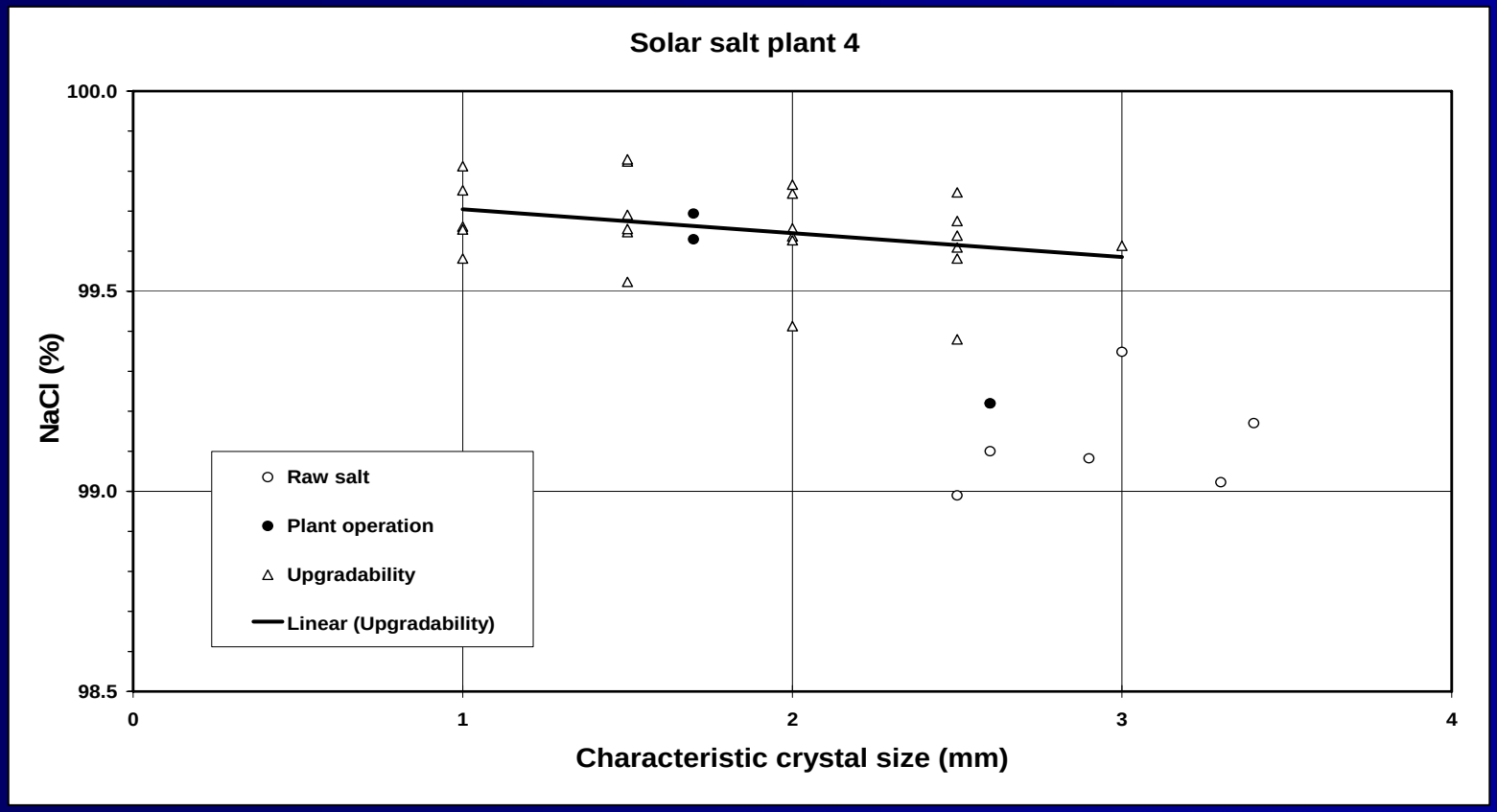
Upgradability of Indian salts



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HYDROSAL refined solar salt and Swiss vacuum salt

		HYDROSAL refined salt	Swiss vacuum salt
CaSO4	ppm	136	17
MgSO4	ppm	55	5
MgCl2	ppm	74	
Na2SO4	ppm		420
Insolubles	ppm	20	20
NaCl	%	99.972%	99.954%

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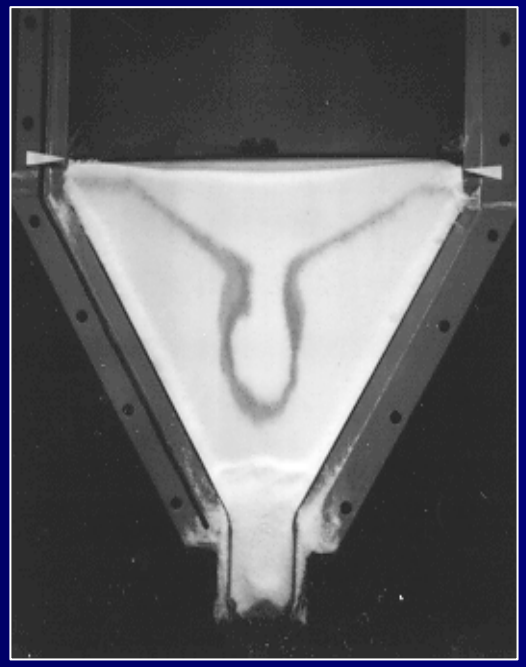
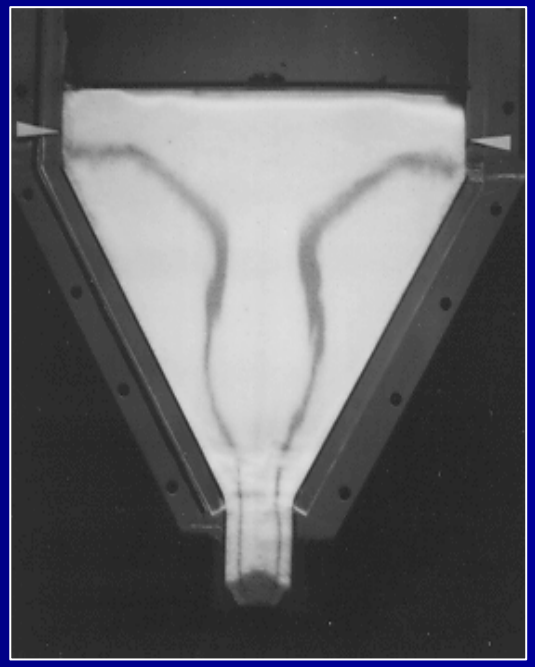
Hydroextraction does not work in all vessels



In this vessel salt flows out mainly through the centre



In the centre of the vessel rat hole develops

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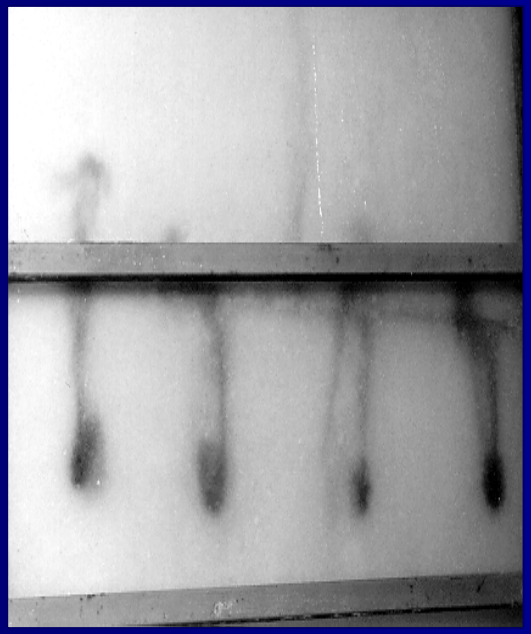
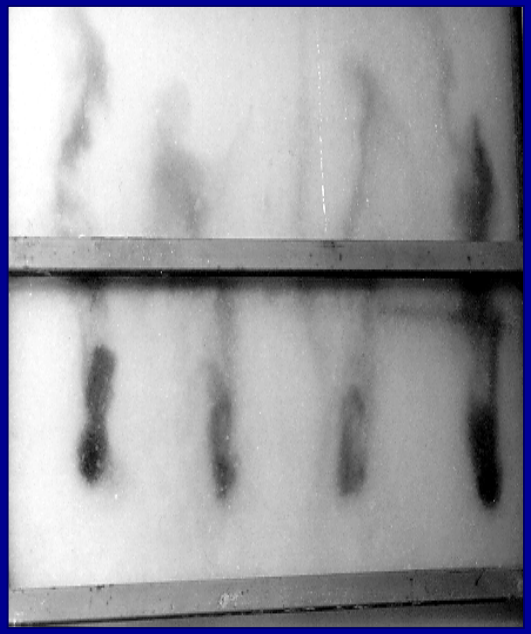
Hydroextraction works only with plug flow of salt

Picture 1: Injection of black ink into brine flowing upwards through salt flowing downwards in plug flow



Picture 2: Black ink flows upwards with brine in counter-current flow



Picture 3: Second black ink injection. There are no traces of black colour in the salt flowing downwards in plug flow

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SALEXPOR 15 t/h solar salt refining plant in Portugal

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100 t/h industrial salt upgrading plant in Spain

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40 t/h salt upgrading plant in Portugal producing purest industrial salt in Europe

		Performance test
Ca	ppm	0.6
Mg	ppm	0.2
SO4	ppm	53

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Solution mining for natural gas storage, co-generation, brine purification, salt crystallisation and refining plant in Portugal

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Solution mining, salt crystallisation and chloralkali project of Hindustan Salts at Mandi in Himachal Pradesh

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