Treatment of Zincor Effluent with Powder Calcium Carbonate (Sappi Enstra)

by

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Background

- Zincor utilises a typical roast-leach-electrowinning process to produce:
  - super high-grade quality zinc together with several other zinc grades and
  - zinc- aluminium alloys from zinc sulphide concentrates.

- Concentrates are sourced mainly from southern African mines with a portion being imported.

Problems/Shortfalls

- Zincor refinery required management of acidic effluent and impurities such as Mg, Mn, Pb, Si, etc.
- High levels of impurities on the spent electrolyte had a negative effect in terms of:
  - Electrowinning efficiency
  - Plant stability
  - Zinc production and final product
- Lime was used at Zincor to treat final effluent and the disadvantage is high cost.
- Zincor and CSIR embarked on a process to develop and implement technology using $CaCO_3$

Demonstration Scale

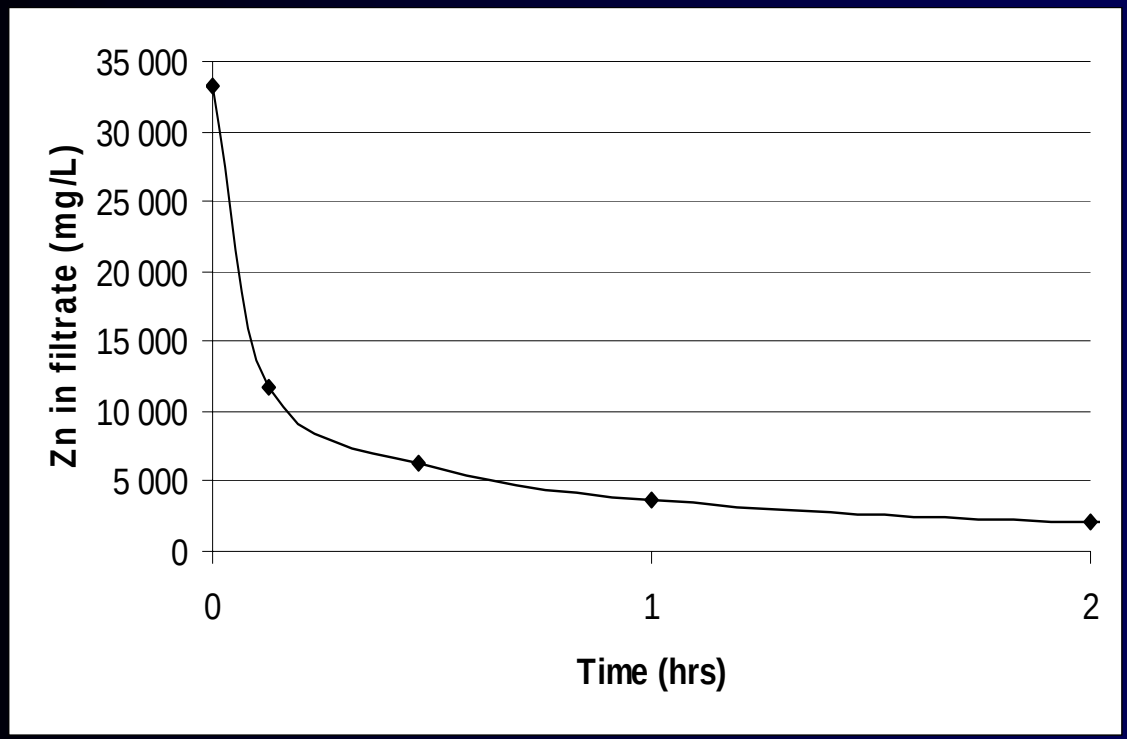
Experimental

- The following conditions were applied for control experiments:
  - Powder $CaCO_3$ slurry concentration (20%)
  - Excess $CaCO_3$ concentration (20%)
  - Mixing intensity (2200rpm)
  - Temperature
  - Total active reactor volume

Bed expansion in the vessel

- 30 % bed expansion was experienced in the demonstration unit
- In 60 m^3 vessels only 150 to 200 mm bed expansion (< 5%) is expected.
- Smaller volume of air for the specific surface area will be applied

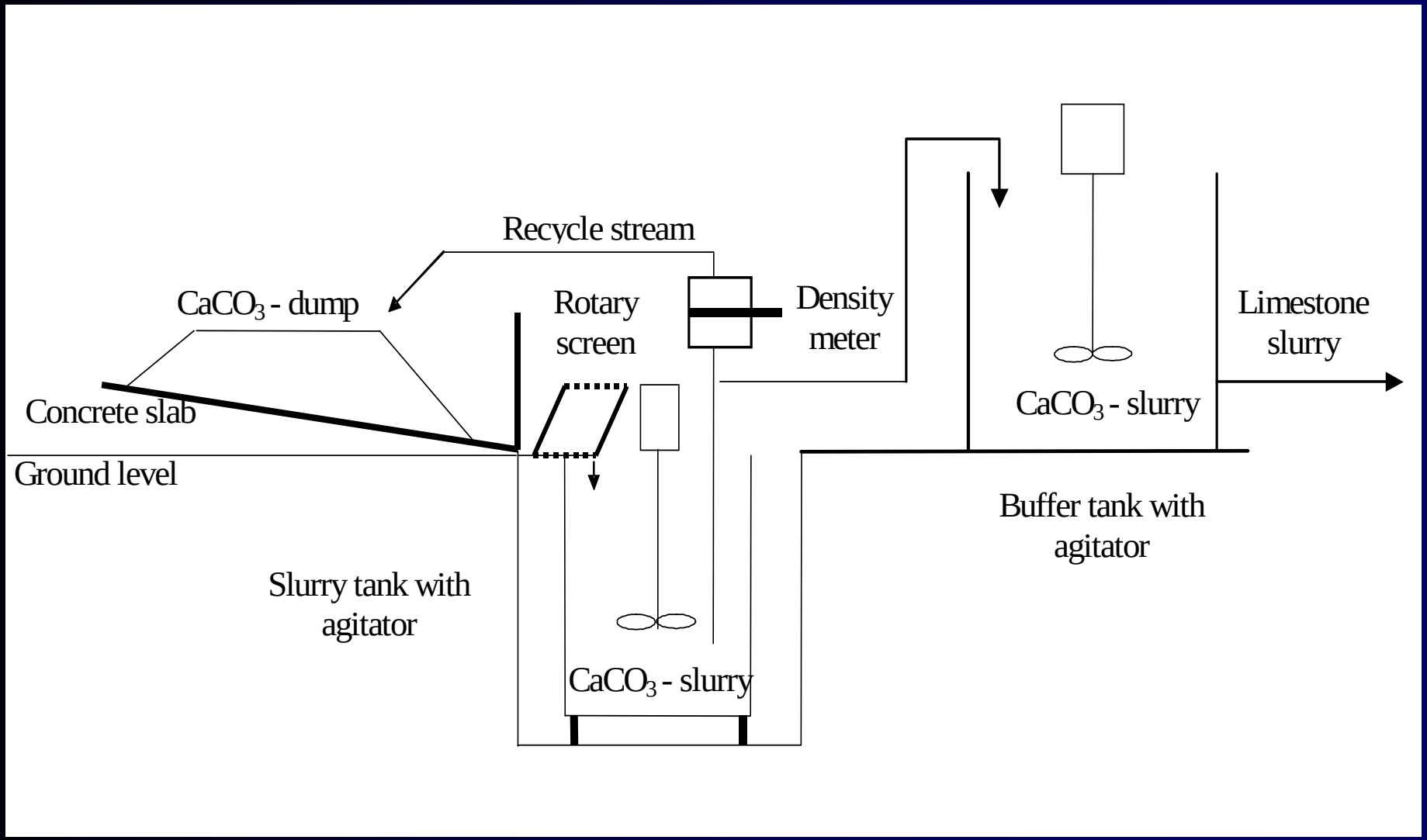
Laboratory test work



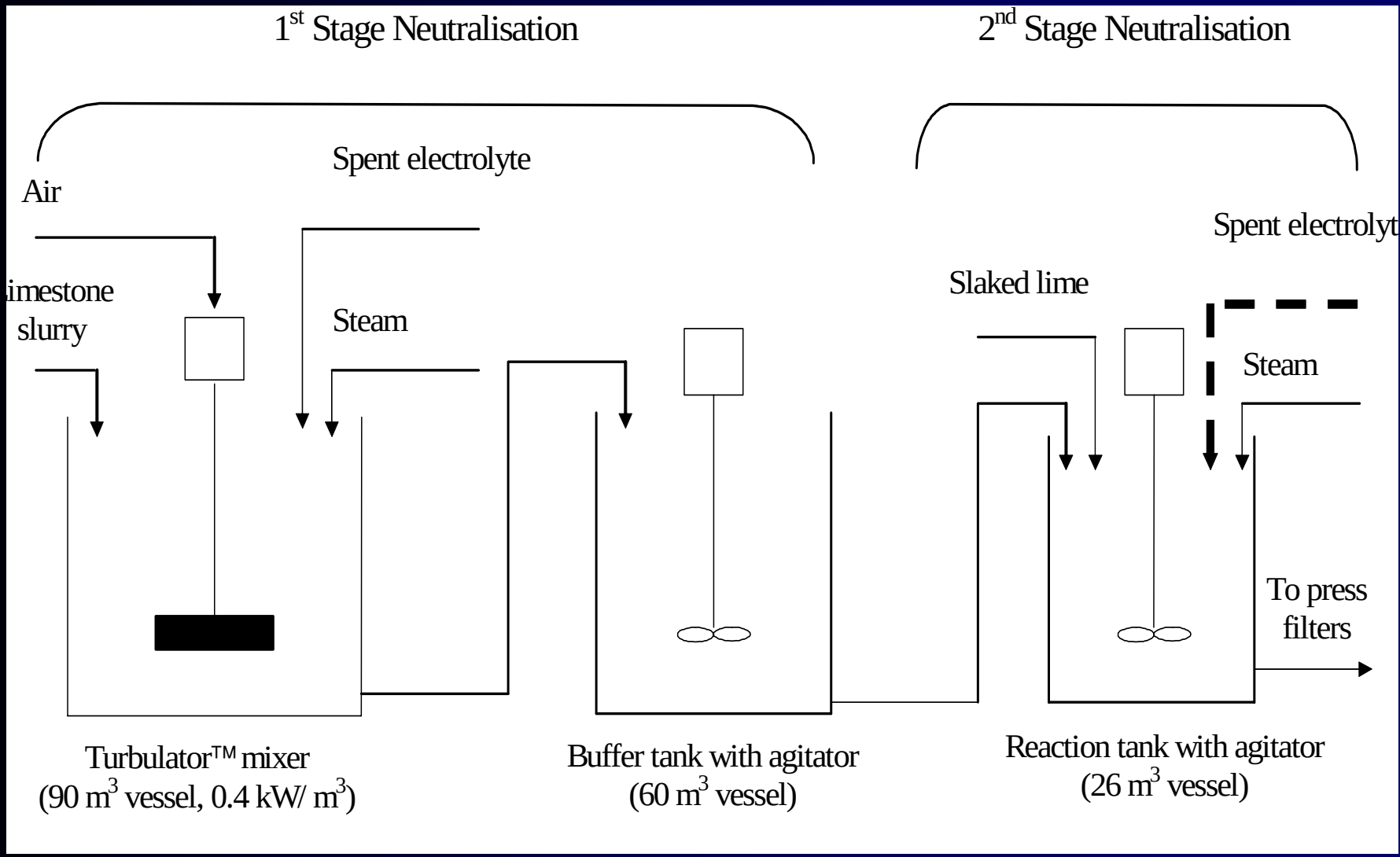
Optimum conditions

- Temp. (70^0C)
- Slurry con. (20%)
- CO_2 stripping applied
- Excess $CaCO_3$ (20%)
- HRT (2hrs and longer)
- High mixing intensity

Schematic diagram of existing plant



Full-scale plant



Plant effluent before and after treatment

Parameter	Units	Effluent (Penstoc	$CaCO_3$ treated	Lime treated (Thickener
pH		2.6	6.6	9.3
Sulphate	mg/l as SO_4	11000	7300	2590
Chloride	mg/l as Cl	230	230	230
Fluoride	mg/l as F	1	1	1
Alkalinity	mg/l as $CaCO_3$	0	624	111
Acidity	mg/l as $CaCO_3$	6999	2988.1	0
Sodium	mg/l as Na	190	300	312
Calcium	mg/l as Ca	217	400	615
Magnesium	mg/l Mg	300	344	199
Aluminium	mg/l as Al	128	0.3	0.3
Manganese	mg/l as Mn	325	300	42
Iron(II)	mg/l as Fe	55.9	0.9	0.2
Iron(III)	mg/l as Fe	91	0	0
Cobalt	mg/l as Co	1.7	0.2	0.2
Nickel	mg/l as Ni	2.6	0.4	0.4
Copper	mg/l as Cu	30	0.2	0.3
Zinc	mg/l as Zn	1350	1300	5.5

CSIR/ZINCOR

- The work done by CSIR/ZINCOR involved:
  - Implementation of a handling and dosing system of powder $CaCO_3$
  - Replacement of lime with powdered $CaCO_3$ for neutralization of penstock return water
  - Identification of conditions required to neutralize free acid and precipitate zinc from spent electrolyte using powder $CaCO_3$

Benefits of using $CaCO_3$

- Full-scale implementation of this technology offered Zincor mine:
  - 75% reduction in lime comsumption
  - 55% reduction in the cost of raw material
  - safer and easier handling of neutralizing agent
  - increased neutralization capacity and process stability

Cont.

- Simplified process control
- Minimisation of material wastage
- Elimination of hazardous chemicals used for neutralization
- Utilisation of equipment at existing lime neutralization plants was possible