

The Intec Nickel Laterite Process

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Production of Nickel from Laterites

- Approximately 70 % of world nickel resources are contained in laterites
- Only 30 % of world nickel production comes from hydrometallurgical treatment of laterites
- Hydrometallurgical production from laterites expected to pass 50 % of total by 2012

Chequered History of Hydrometallurgy for Nickel Laterites

- Long-running successful but antiquated operation at Moa Bay, Cuba
- Technical problems at Western Australia's three HPAL plants during late 1990's
- Significant capex increase at 'second generation' HPAL plants at Ravensthorpe and Goro
- Shelving of Jaguar Nickel's atmospheric chloride leach process in Canada

Intec Nickel Laterite Process (INLP) Design Goals

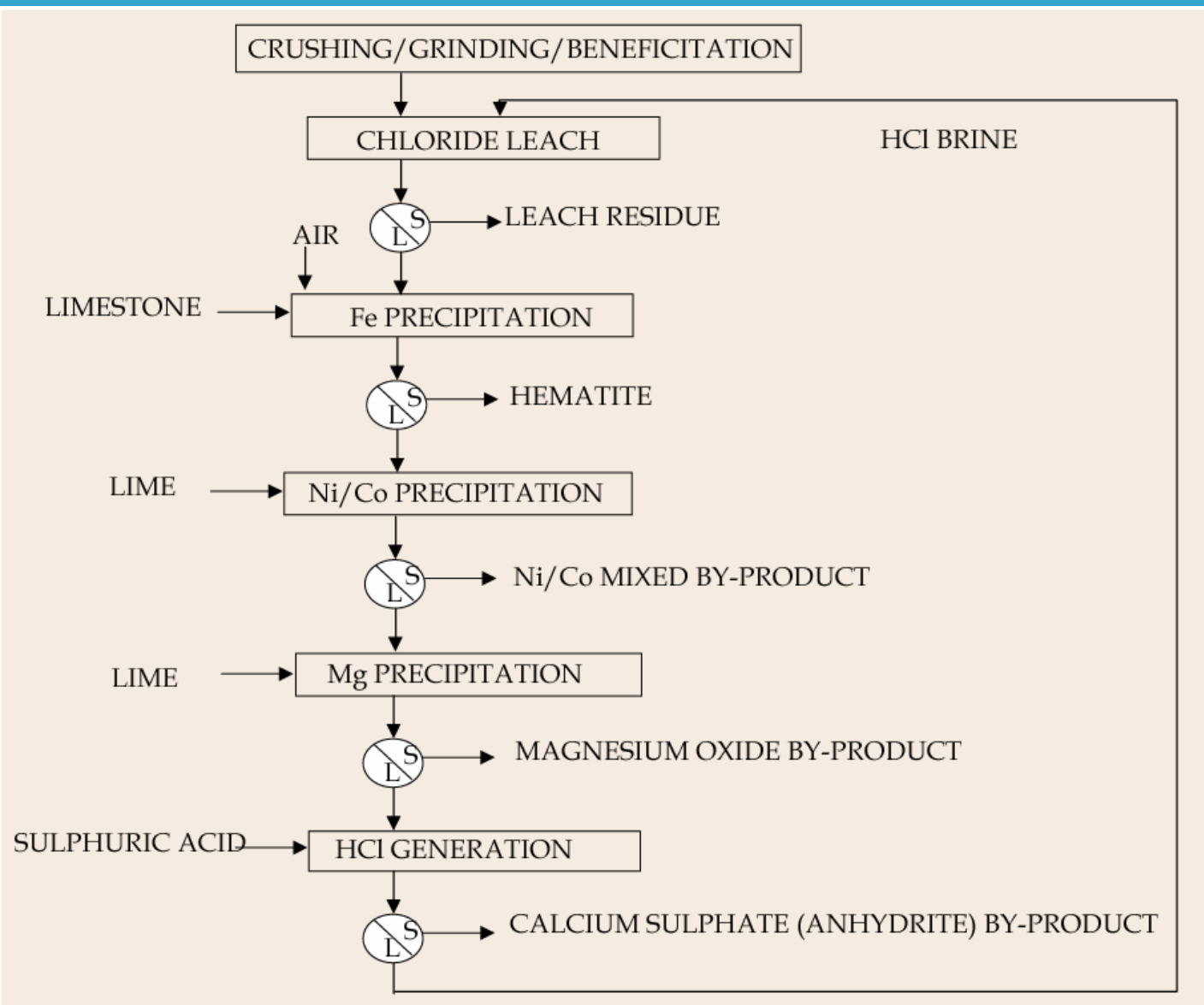
To recover Ni & Co from limonitic laterite ores at high efficiency utilising the advantages of chloride chemistry:

- Minimise acid consumption
- Minimise leach intensity
- Maximise leach residue filterability
- And therefore reduce costs

INLP Fundamentals

- Liquor based on $\text{NaCl}/\text{CaCl}_2$
- Acid from conventional acid plant (H_2SO_4)
- pH adjustment with limestone/lime

INLP Flowsheet



INLP Leach Options

1. Atmospheric Leach at 95-105 °C
2. Pressure Leach at 150-220 °C
3. Combination dependant on mineralogy

INLP Chemistry

Hydrochloric Acid Generation



- High purity bassanite by-product is saleable
- Highly filterable
- Moisture content 5-10 %
- Background sulphate <2 g/L in process liquor

INLP Chemistry

Leach Reactions for Goethite



- H^+ activity enhanced 5 times in high molarity chloride
- Hematite favoured by seeding, elevated temperature, chloride, and retention time

INLP Chemistry

Iron Precipitation



- Lost Ca^{2+} is restored
- Hematite formation by controlled supersaturation precipitation
- Highly filterable
- Saleable or stable for disposal

INLP Chemistry

Ni/Co Recovery



- Mixed Ni/Co oxide by-product proposed
- Lost Ca^{2+} is restored by use of Ca alkalis

INLP Chemistry

Magnesium recovery



- Magnesia by-product for disposal
- Lost Ca^{2+} is restored

Laterite Ore Tested

Nickeliferous Limonite (Fe,Ni)OOH

Source	Chemical Analysis (wt%)			
	Ni	Co	Fe	Mg
Western Australia	1.17	0.061	21.9	2.42

Particle Size Distribution

Fraction (μm)	Wt%	Ni % of Total
>212	6.13	4.8
106-212	9.76	11.58
38-106	25.60	30.34
<36	58.51	53.21

- Negligible upgrade potential by screening

Acid Generation & Bassanite Precipitation



Brine Composition (g/L)

Ca	Co	Fe	Mg	Mn	Ni
50	2.7	35	30	17	14

Residue Composition

Ca %	Co ppm	Fe ppm	Mg %	Mn ppm	Ni ppm	Cl ppm	S %
27.3	<0.1	70	<0.01	20	5	100	21.1

INLP Leach Results

Atmospheric Leach 100-105 °C

H ₂ SO ₄ kg/t	Co %	Ni %	Fe %	Mg %
100	88	44	31	49
400	93	72	56	67

- Residue filterability moderate - poor
- 8 hour leach time

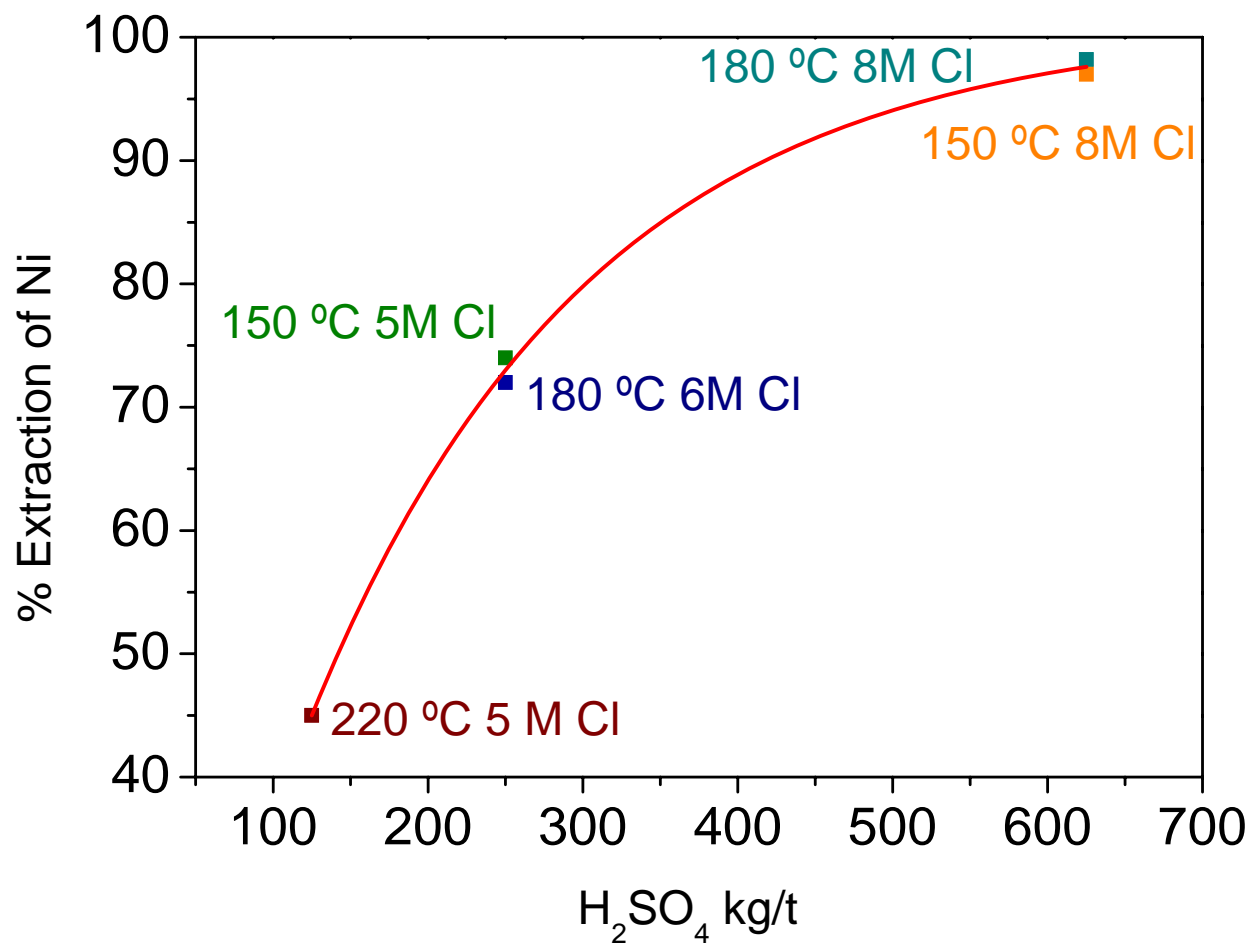
INLP Leach Results

High Temperature 150-220 °C

H ₂ SO ₄ kg/t	Cl M	°C	Co %	Ni %	Fe %	Mg %
100	5	220	>99	44	25	48
250	5	150	98	74	49	68
250	6	180	97	72	44	67
625	8	150	99	97	90	96
625	8	180	>99	98	95	98

- Residue highly filterable
- 2 hour leach time

INLP Leach Results Summary



Pressure at Elevated Temperatures

Temperature (°C)	Intec (bar)	H ₂ O (bar)
150	4	5
180	8	10
220	18	23
250	32	40

Summary Benefits of Cl versus SO₄

- Readily filterable residues
- Lower acid consumption
- Saleable by-products to offset acid
- Lower temperatures for pressure leach
- Lower pressures

Future Development of INLP

- Optimise electrolyte composition
- Optimise acid input
- Optimise leach temperature
- Extend experience to other laterites

Intec Needs at Nickel Laterite Project Partner

- Intec has limited resources, all of which are presently focused on its Hellyer Project
- INLP development program would begin at University of Sydney laboratory
- INLP pilot plant at Burnie, Tasmania
- Link INLP to limonitic resource for competitive advantage
- Therefore come and see us!!

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