

Recovery/ Recycling: Making Your Industry Environment Friendly.

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Seminar on “Energy Conservation and Industrial Waste Management”,

INTRODUCTION:

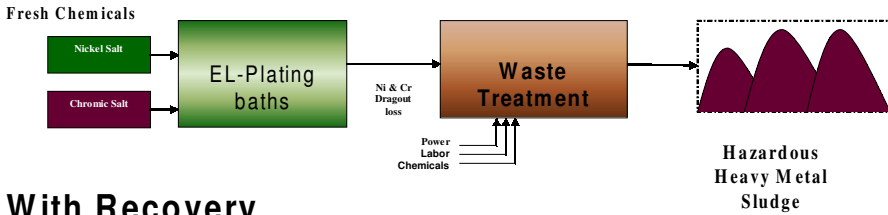
- In almost all industries, waste liquid effluent discharge is unavoidable.
- Rapid industrialization has made it a need to impose stringent effluent discharge norms.
- End-of –the –pipe treatment or Effluent Treatment Plants (ETP) are traditionally employed. This may prove ineffective or costly to achieve the discharge norms.
- Appropriate cleaner technologies should be identified and recovery/ recycling systems employed.
- Major benefits and rapid payback can be achieved.

RECOVERY/ RECYCLING of Industrial Process Waste Solutions.

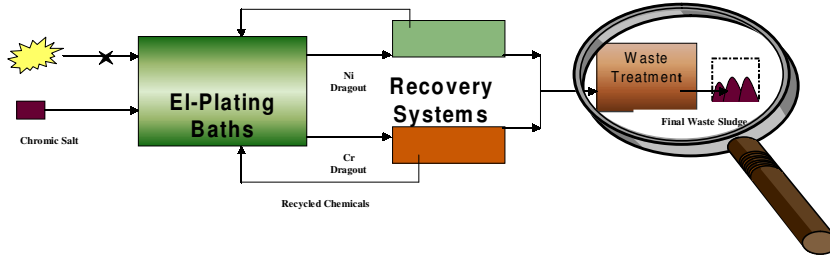
- **BENEFITS:**
- **SAVINGS FROM REDUCED CHEMICAL CONSUMPTION / PURCHASES.**
- **REDUCTION IN DISCHARGE OF HAZARDOUS CHEMICAL WASTE.**
- **ELIMINATES OR MINIMIZES WASTE TREATMENT COSTS.**
- **ON LINE PURIFICATION ALLOWS A CLEANER PROCESS / OPERATION, ENHANCING ENERGY SAVINGS, PRODUCT QUALITY & PRODUCTIVITY**
- **COSTS SAVING BENEFITS RESULTS IN A RAPID PAYBACK ON INVESTMENT.**

BENEFITS OF RECOVERY / RECYCLING

Without Recovery



With Recovery



REDUCED:

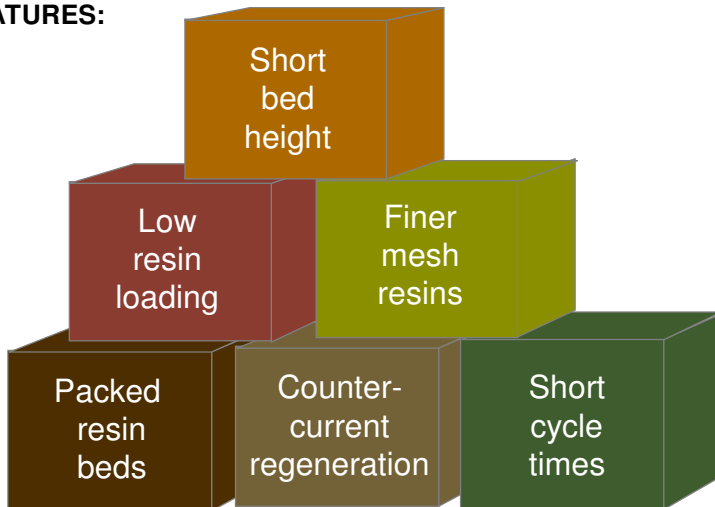
- Chemical Purchases.
- Waste Treatment.
- Hazardous sludge generation and disposal problems.

Identifying the Appropriate Recovery/ Recycling Technology:

- There are a number of technologies that cater to specific industrial processes. They include: Filters, RO, Ion exchange, Evaporators, etc.
- The appropriate technology needs to be identified and employed for the specific need to ensure maximum benefit to the user.
- This paper discusses one such technology using short-bed advanced ion exchange, that has been employed successfully over the past several years for certain specific applications mainly in the metal finishing operations (steel pickling, Aluminum anodizing, electro-plating, etc.). Certain case studies and the economic benefits are also discussed.
- Advances made in ion exchange technology has helped overcome the limitations of conventional ion exchange from beyond normal water treatment to purification/ reuse of industrial chemical solutions.

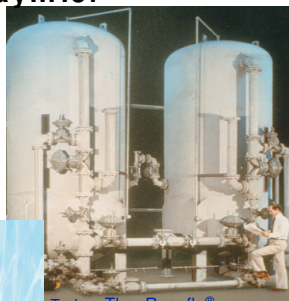
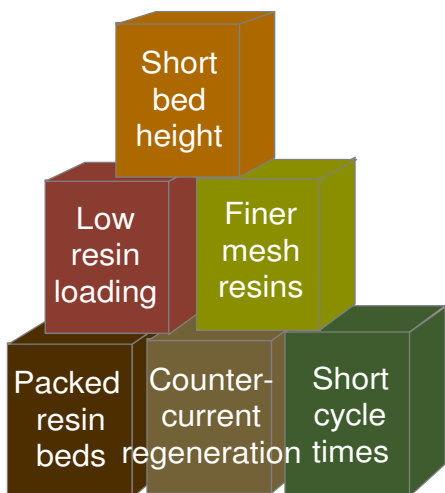
Appropriate Recovery/ Recycling Technology using Short Bed Ion Exchange for certain specific applications:

FEATURES:



Ion Exchange- The Evolution

Yesterday...or



... Today



RecoFlo Chemical Purification / Recycling Units.



Amine Purification (AmiPur) Unit



Acid Purification (APU) Unit

Nickel Recovery (NiRU) Unit



Chrome Purification (ChromaPur) Unit



SHORT-BED ION EXCHANGE APPLICATIONS:

- **STEEL PROCESSING:** Purification of pickling acids and electrogalvanizing acids/
- **ALUMINIUM FINISHING:** Purification of Anodizing baths/ Caustic etchants/ Phosphoric acid brightener baths/ lithoplate grainer acid baths/ etc.
- **ELECTROPLATING:** Nickel and Chromic acid recovery from rinse/ Purification of hard chrome baths, etc.
- **MINERAL PROCESSING:** Copper/ Zinc Refinery, cell house acid bleed purification.
- **PETROCHEMICALS:** Amine purification in gas sweetening operations/ Produced water softening.
- **CHLORO-ALKALI:** Selective removal of sulphates from brine solutions/ Fine filtration of brine solutions.
- **SEAWATER PURIFICATION/SOFTENING:** Selective removal of Ca, Mg hardness and SO₄ removal.

Major accounts

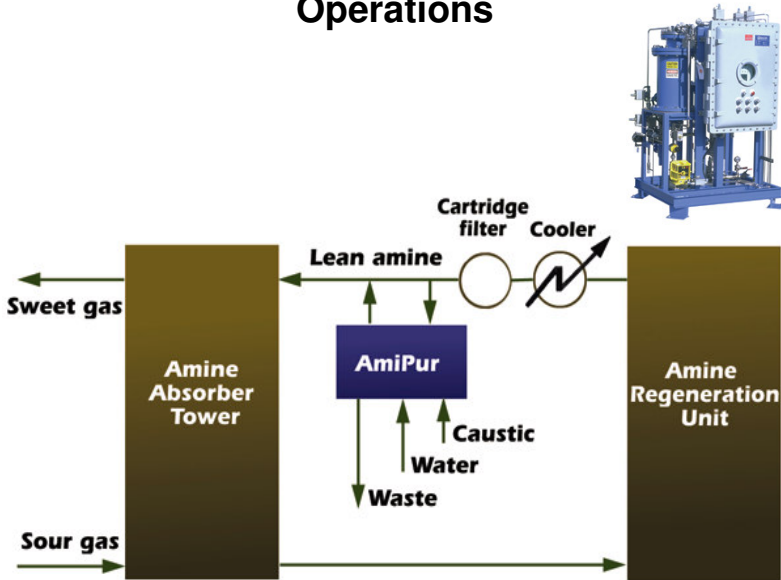


RECOFLO PURIFICATION SYSTEM INSTALLATIONS IN INDIA

- 1994 : **SALEM STEEL PLANT (SAIL)**, Tamil Nadu.
- - (Stainless steel pickling acid baths (HF/ HNO₃) Purification System).
- 1996 : **SEARCHCHEM (G.E) POWER PLANT**, Jagadia, Gujarat.
(Water treatment DM System).
- 1997 : **TECHNOVA IMAGING SYSTEMS**, Taloja, Maharashtra.
- (Phosphoric Acid Purification System).
- 1998 : **BAJAJ AUTO LTD**, Aurangabad, Maharashtra.
- - (Decorative Chrome Plating Rinse Recovery System).
- 2000 : **TVS MOTORS**, Hosur, Tamil Nadu.
- - Chrome Plating Rinse Recovery System).
- - Nickel Plating Rinse Recovery System.
- 2001 : **STERLITE COPPER**, Silvassa
- - (Electrolyte Bleed Acid (H₂SO₄) Purification System).
- 2001: **SHRIRAM PISTONS & RINGS**, Ghaziabad.
- - (Hard Chrome Plating Bath Purification System).
- 2002 : **RELIANCE PETROLEUM**, Jamnagar.
- - (Amine Purification System)
- 2003 : **TECHNOVA IMAGING SYSTEMS**, Taloja.
- - Grainer Bath Mixed Acid (Ac. Acid + HCl) Purification System.
- - Anodizing Bath Acid (H₂SO₄) Purification System.

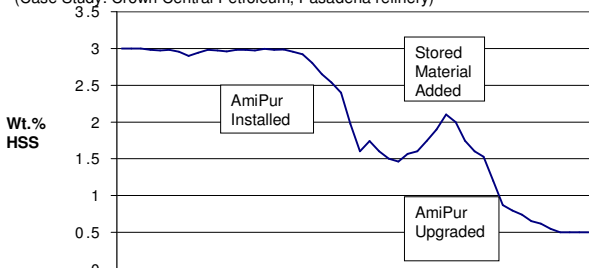
CASE HISTORY:

Amine Purification in Gas Sweetening Operations

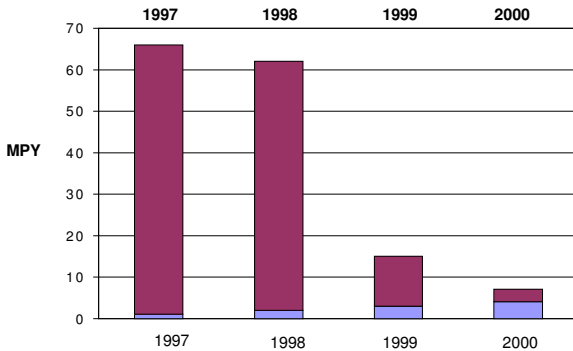


Benefits of Amine Purification (Gas Sweetening Operations):

(Case Study: Crown Central Petroleum, Pasadena refinery)



Contaminant Heat Stable Salt (HSS) decreased in the amine loop.



Reduced corrosion (with reduced HSS). Decreased from 65 MPY to avg. <10 MPY

BENEFITS: (with reduced corrosion within the process equipment, piping, etc.)

- Reduced foaming and improved efficiency in absorber column.
- Productivity improvement.
- Re-boiler efficiency improved (and lower energy consumption).
- Filter replacement frequency decreased several times.
- Amine inventory reduced.

ELECTROPLATING:

- **NICKEL Salt Recovery:**

- Over 99% Ni. Bath solution lost to drag-out can be recycled.
- Fresh Ni. Salt purchases and waste treatment minimized.

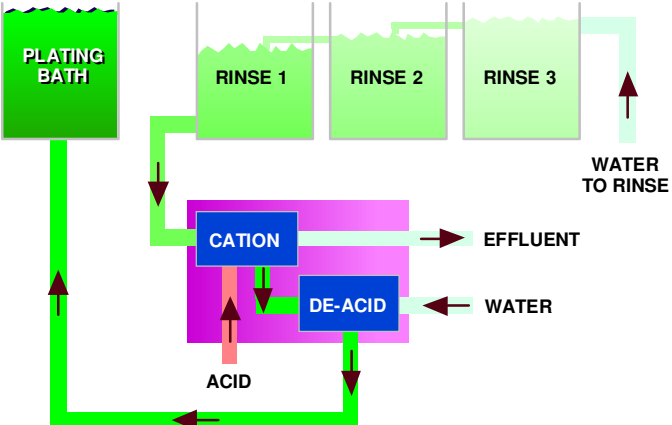
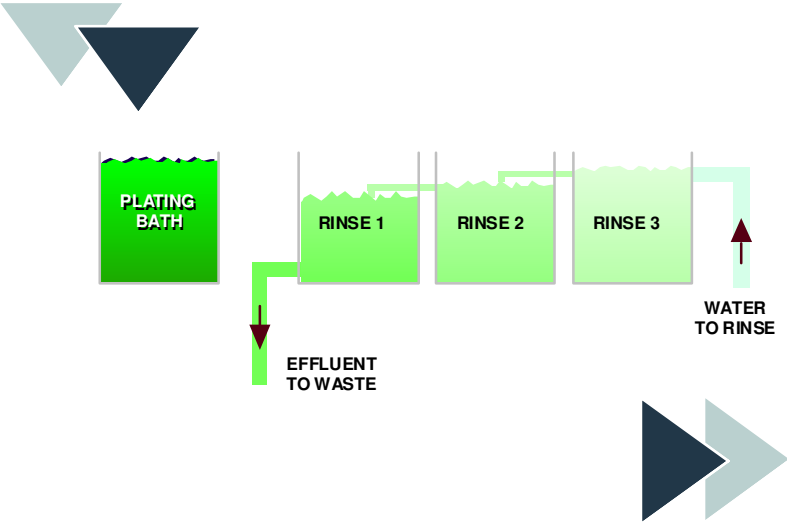
- **CHROME Drag-out Recovery:**

- Over 98% recycled to baths in purified form
- Reduced chrome purchases.
- Reduced waste treatment and hazardous sludge disposal problem.

- **Hard Chrome Bath Purification:**

- Dissolved contaminants separated out and purified bath maintained.
- Enhanced productivity & plating quality. Reduced operating costs.
- Reduced chrome purchases and waste treatment.

Nickel plating



Recoflo nickel salt recovery unit



Economic Evaluation: NICKEL RECOVERY SYSTEM

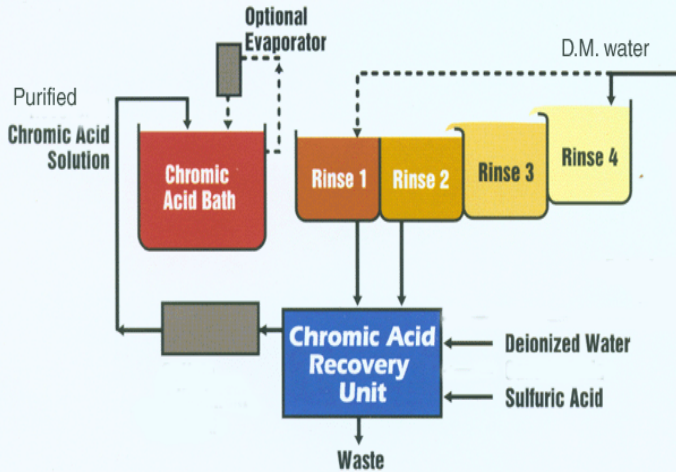
((Electro Plating Operation for Motorcycle components (Rims, Mufflers, etc).

Basis: Pltg Bath Dragout = 575 gm/l (as Ni).

Operating hrs.= 24 hrs x 6 days x 52 wks = 7488 hrs/yr

Component	Without Recovery	With Ni Recovery	Annual Savings TPA	% Rs.	
1) Nickel Salts (SO4 + Cl)	18.6 TPY	0.37 TPY	98%	18.27	72.75 Lacs
2) Regenerant HCl Acid (32%)	-----	3.80 TPY		(3.8)	(0.19)Lac
3) Sulphuric Acid	----	6.92 TPA		(6.92)	(0.69)L
4) Lime (for waste treatment)	5.80 TPA	14.30 TPA	+ 46%	(8.50)	(0.21) L
5) Process Water	7,500 M3 (Rs.15/M3)	3,700 M3 (Rs.25/M3)	50%	3,800M3	0.20 L
Total Savings				Rs.72.86 Lacs/yr	
Payback on installed cost < 1.5 years.					

Chromic Acid Recovery



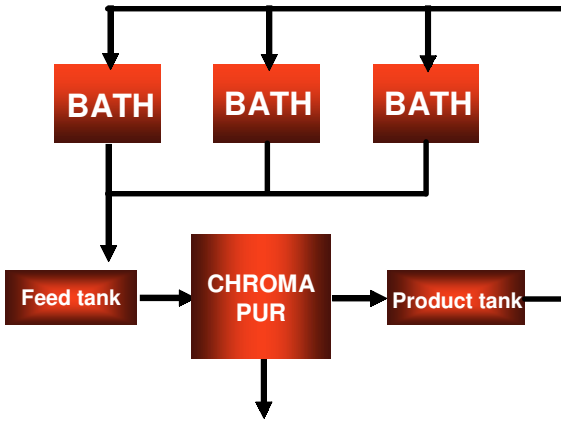
Economic Evaluation: CHROME RINSE RECOVERY SYSTEM

((Electro Plating Operation for Motorcycle components (Rims, Mufflers, etc).

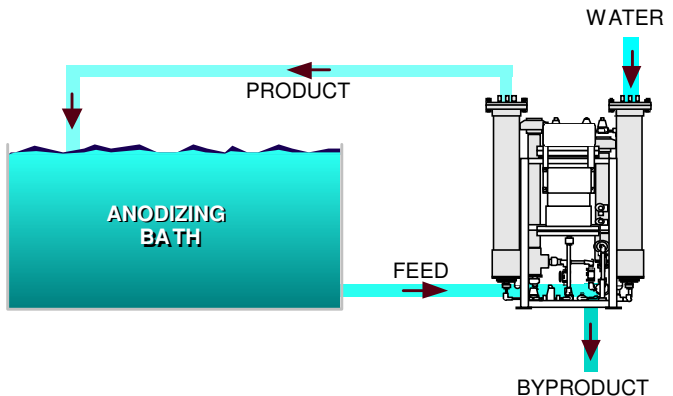
Basis: Chromic acid dragout = 3.06 kg/h (or 61lts/h at 50 gpl CrO3).

Component	Without Recovery	With Recovery	SAVINGS/ year		
			%	Quanty	Rs.Lacs
1) Chrome Loss In dragout.	22.05 TPY	1.10 TPY	96%	20.95TPY	Rs28.28 L
2)Metabisulfite	32.19 TPY	1.61 TPY	96%	30.58TPY	Rs10.09 L
3)Sulfuric Acid	17.40 TPY	30.32 TPY	-74%	(12.92T)	(Rs1.40 L)
4)Caustic Soda	27.80 TPY	12.80 TPY	54%	15.00TPY	Rs2.40 L
5)Sludge (20%w)	114.0 TPY	15.10 TPY	87%	98.90TPY	Rs0.50 L
6)Process Water	19455.M3 (@Rs15)	981.0 M3 (@Rs25)	95%	18,474M3	Rs3.64 L
ANNUAL SAVINGS		Rs. 43.51 Lacs			
Payback on installed cost = 2.0 to 3.0 years					

Hard Chrome Bath purification schematic



Aluminum Anodizing Bath Acid Purification



STEEL FINISHING:

- **PICKLING ACID PURIFICATION:**

- Nitric/Hydrofluoric Acid (Stainless Steel pickling)
- Sulfuric acid or Hydrochloric acid pickling operations.
-

- **PURIFICATION of Electro-Galvanizing solutions:**

- **FEATURES AND BENEFITS:**

- Separates out dissolved contaminants from free acids.
- Maintains a Purified bath and consistent operation.
- Enhances productivity and finish quality.
- Reduces acid purchases and waste neutralization.

The Acid Purification (APU) System helps to produce the steel products customers want with . . .

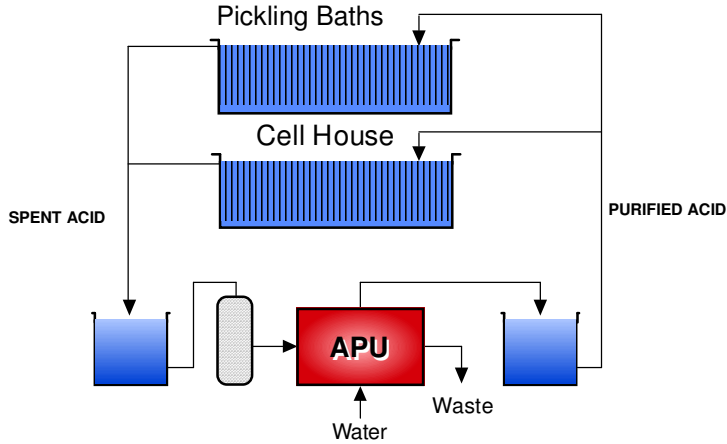
. . . more **uniform** finishes

. . . **faster** process times

. . . **lower production costs**



Steel Pickling Acid Bath Purification



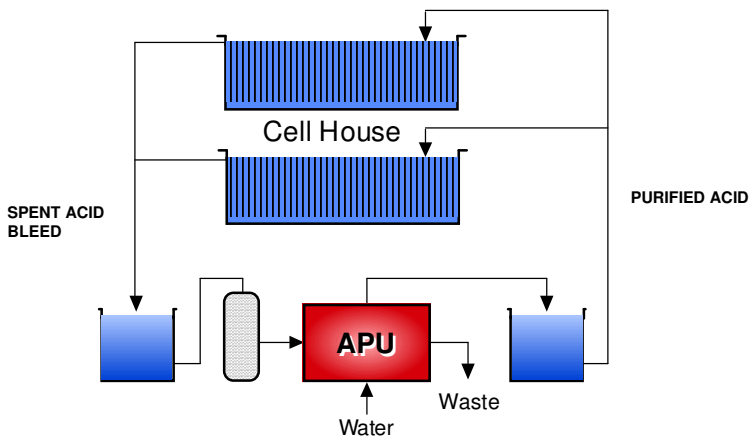
Economics For Acid Purification (APU) System STAINLESS STEEL PICKLING OPERATION.

For

Basis: Contaminant Metal (Fe,Cr,Ni) in pickling bath = 50 kg/h
Bath Bleed (without recovery) = 1.0 m³/h at 50 gpl metals

Component	Feed/Bleed (No Recycle)	With APU (Recycle)	SAVINGS/ year		
			%	Quantity	Rs.Lacs
HNO ₃ as100%	1260.0 TPY	111.7 TPY	91%	1448.3TPY	Rs120.57L
HF(as100%)	252.0. TPY	87.4 TPY	65%	164.6TPY	Rs131.52L
Lime(neutzn)	1206.0TPY	227.0 TPY	81%	979.0TPY	Rs24.48 L
Sludge (25%S)	1404.0 TPY	502.0 TPY	64%	902.0TPY	Rs2.71 L
Water for APU (m ³ /h)		17150 M3	--	17150 m3	(Rs1.72 L)
El. Consumption (12 kwh/h)		100,800kwh	--	100800kw	(Rs3.02 L)
Other APU operating costs				Misc	(Rs12.00L)
ANNUAL SAVINGS				Rs.254.54 Lacs	
Payback on installed cost = 2 to 3 years					

COPPER REFINERY Electrolyte purification



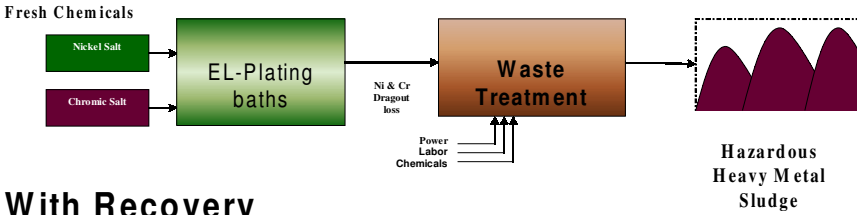
Economics For Acid Purification (APU) System For COPPER REFINERY ACID BLEED.

Basis: Waste Acid Bleed (without recovery) = 60 m³/d (at 240 g/l H₂SO₄ or 14.4 TPD)

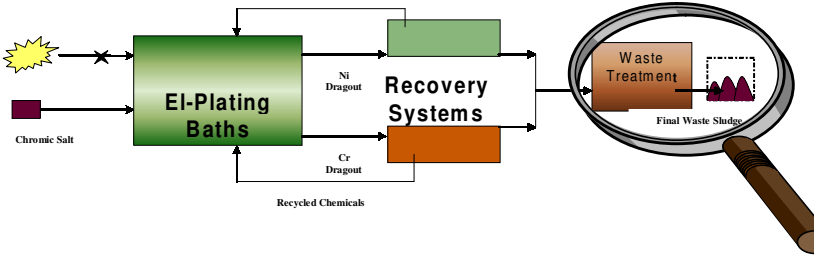
Component	Feed/Bleed (No Recycle)	With APU (Recovery/ Recycle)	SAVINGS/ year		
			%	Quantity	Rs.Lacs
1) H ₂ SO ₄ Loss (as 100%)	4968.TPY	587.0 TPY	88%	4381.0TPY	Rs87.62 L
2)Lime(neutzn)	3776. TPY	446.0 TPY	88%	3330.0TPY	Rs83.25 L
3)Ca Sludge (25% w/w)	27821TPY	446.0 TPY	88%	24534.TPY	Rs61.34 L
4) Water for APU	----	20700 M3	--	20700 TPY	Rs31.05 L
5) El.Power for APU (15kwh/h)		99360kwh	--	99360kwh	Rs39.74 L
6)Other APU operating cost.		Misc.	---	---	Rs6.75 L
ANNUAL SAVINGS				Rs.218.37 Lacs	
Payback on installed cost < 2.0 years					

BENEFITS OF RECOVERY / RECYCLING

Without Recovery



With Recovery



CONCLUSION:

Clean Technology & Recovery / Recycling will:

- Result in a more efficient use of resources and energy.
- Promote a more competitive economy.
- Minimize waste, generation of pollutants & health risks.
- Prevent conversion of pollutants from one medium to another.
- Fulfill one's moral responsibility towards the environment.

Support, Promote, Use Clean Technology and help:

“RECOVER THE FUTURE.”