

**ECONOMIC BENEFITS OF PICKLING WITH ACID LIFE EXTENDER:**

**A CASE STUDY  
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## **1. ACID LIFE EXTENDER**

A proprietary chemical product, PRO-pHx Acid Life Extender, has been available in South Africa for the past five years. The product finds application in acid pickles used in the metal finishing industry. Processes like hot dip galvanizing, wire galvanizing, anodizing, electro-polishing and electroplating can benefit from its use.

The product is added to an acid pickle bath, preferably a newly made up one, in the ratio of 1% of the volume of the bath. (A Double Strength product is also available, with addition of 0.5%) Any further concentrated acid additions, to maintain the acid concentration, must also contain 1% Acid Life Extender of the added volume.

The Acid Life Extender converts the soluble metal in the pickle bath to insoluble metal silicates that can be filtered out. The metal concentration in the pickle stabilizes and the pickle does not have to be decanted, dumped or recycled.

## **2. FILTRATION**

To filter out the solids formed by the reaction in the pickle tank an adequately sized filtration system must be added. For smaller volumes filter units with cartridges can be used, but for larger volumes an automatic backwash plc controlled filter unit is needed. Such a filter unit can have one to four filter chambers.

The backwash cycle is initiated by a pre-set pressure, or a timer (typically 1.5h). Chambers are backwashed sequentially, with the filtration being maintained in the chamber(s) not in a backwash cycle.

At the start of a backwash cycle, the inlet to the chamber is closed, and the chamber is air purged back to the pickle tank to prevent any loss of acid. Thereafter the chamber is backwashed with mains or pumped rinse water, to waste. After the backwash cycle the chamber is again air purged, to waste, to clean out any remaining water. Thereafter the inlet valve is opened, filtration is started again, and the next chamber starts its backwash cycle. The chambers can each hold 2kg of solids.

## **3. CASE STUDY**

In January 2014 a South African company with wire galvanizing lines, each producing +/- 30 000tons/year, installed an automatic backwash filter system with 2 chambers on one line and introduced the Acid Life Extender Double Strength chemistry in the associated pickle tank.

The pickling was traditionally done with 16% regenerated HCl. Concentrations normally varied from 14 to 7% with the Fe concentration typically 7%.

With the Acid Life Extender the HCl concentration was maintained at 10% by adding 30% virgin HCl treated with Acid Life Extender. The Fe concentration stabilized at 7 to 8%.

Mains water was used for the backwash. There is no drag in to the pickle tank as the wires enter dry. It is important to have more drag out than drag in to enable acid additions without having to decant.

With the acid concentration maintained at 10%, compared to the previous average higher concentration, neutralization costs of the rinse water is reduced.

Initial problems were experienced with the filtration, caused by calcium solids in the acid pickle, coming from the calcium based wire drawing soap. The filter gradually managed to clean the acid adequately to cope with the load of metal silicates and calcium solids.

Another problem was experienced with the back wash water. Initially rinse water that normally goes to the WWT plant, was pumped for back wash cycles. However, the volumes were not adequate, and mains water had to be used for back washing. This problem is addressed below. The volume of back wash water is typically 60l per chamber per back wash.

The consumptions and operating parameters were closely monitored and compared with previous results on that line and another similar line using 16% regenerated HCl and periodic decants. The quality of pickle and galvanizing with the converted line was no different from the past.

The acid consumption on the 16% regenerated HCl line averaged at 25kg/t. This equates to 12.5kg/t 30% HCl.

The acid consumption on the 30% HCl top up line stabilized at 5.7kg/l 30% HCl.

The cost benefits were substantial and are set out below.

In the light of the economic benefits associated with using Acid Life Extender, 30% virgin acid and filtration, management decided to convert a second line to Acid Life Extender chemistry with 30% HCl top up and filtration. That line will be commissioned in April 2015.

With two lines operating on the Acid Life Extender and filtration, a rinse water buffer sump will be introduced with back wash water pumped from the buffer tank for each of the two filter units. This will introduce further savings as mains water will not be used.

#### 4. FINANCIAL BENEFITS

The figures below are based on production of 30 000tons/year/line and typical present day unit costs.

16% HCl consumption:	25kg/t
Cost per year @R1.80/kg:	<b>R1 350 000.00</b>
30% HCl consumption:	5.7kg/t
Cost per year @R0.75/kg:	R128 250.00
Acid Life Extender 2X consumption:	0.0248l/t
Cost per year @R350.00/l:	R260 400.00
Electricity consumption:	222kWh/week
Cost per year @R0.70/kWh:	R7 459.20
Water consumption:	20.2kl/week
Cost per year @R17.77/kl:	R17 229.79
Total cost per year with Acid Life Extender:	<b>R413 338.99</b>
<b>Cost Saving per year:</b>	<b>R936 661.01</b>
<b>Cost Saving per month:</b>	<b>R 78 055.08</b>
<b>Percentage Saving:</b>	<b>69%</b>

#### 5. INVESTMENT RECOVERY

The capital cost associated with the introduction of the Acid Life Extender in the acid pickle and filtration, ie:

- initial Acid Life Extender make-up
- filter and pumps
- electrical connections
- pipework, tank conversions, valves, etc

can usually be paid back in 6 to 9 months.

#### 6. CONCLUSION

- Substantial cost savings can be achieved by using Acid Life Extender, 30% HCl and filtration in the acid pickle.
- Neutralization costs are reduced by continuously pickling at a lower constant concentration.
- Storage, handling and transport of waste acid is eliminated.
- Return on investment is well within acceptable financial limits.



**TWO CHAMBER AUTOMATIC BACK WASH FILTER**

## PROPOSED ARRANGEMENT FOR WIRE LINE

