Tekwani Applications Limited
Manufacturers of Jewelwax and Trycut machinable waxes

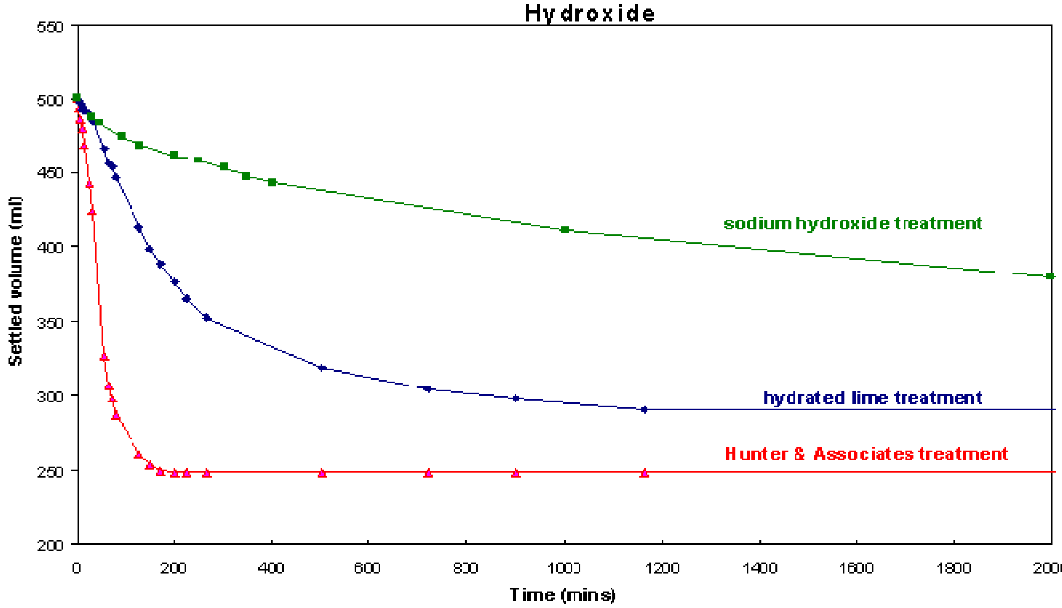
Suppliers of Chemical & Other Technology Services

Chemical Technology Services:

Technology for the Efficient Neutralisation and Precipitation of Metals from Effluent and Process Streams

The removal of metals from effluent and process streams neutralised conventionally with bases such as sodium hydroxide or hydrated lime often produce a slimy gel precipitate which is difficult to settle / filter etc.
Patented technology devised by Tekwani Applications Ltd together with Hunter and Associates (UK) Ltd, uses a series of formulations (the HAPx range), which produce precipitates that settle rapidly (see Figure 1) and are easily filtered to give a *dry* solid of low volume. The process can be optimised for a specific system.

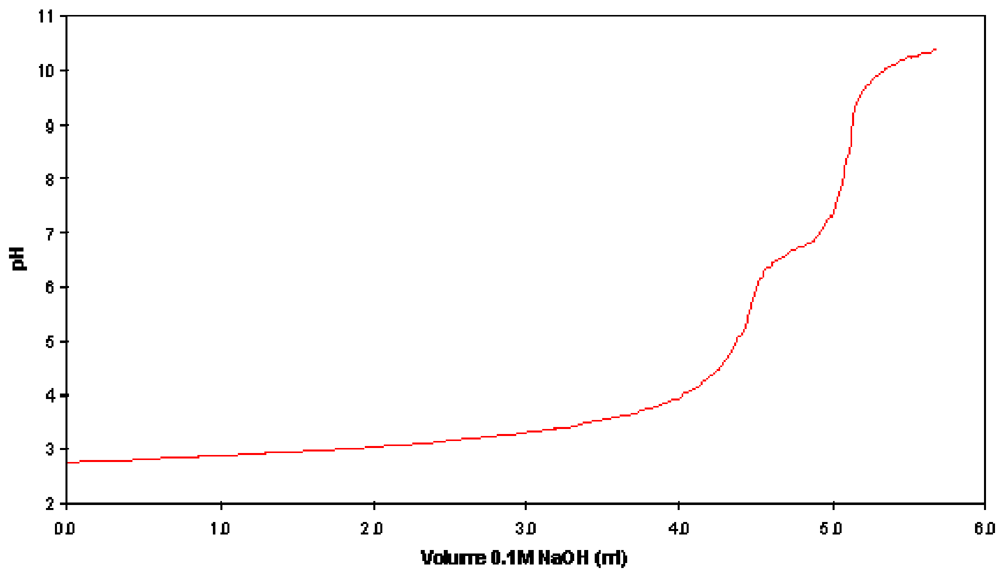
Figure 1 - Comparison of Settling Rates of Precipitated Ferrous Hydroxide



Initially used in the nuclear industry for treating solutions arising from the decontamination of steel surfaces in nuclear power plant, it can be applied to a wide range of processes where metals have to be precipitated and removed from solution. Examples include spent acid and rinsings from the hydrochloric and sulphuric acid pickling of steels and effluents from plating and metal finishing processes.

Control over the pH at the usual 7- 8 range required for precipitating most hydrated metal oxides is essential. An example pH curve using sodium hydroxide for the neutralisation of hydrochloric *pickling* acid containing ferrous ions is shown in Figure 2. The very steep increase in pH for small amount of NaOH added, is evident over this pH range.

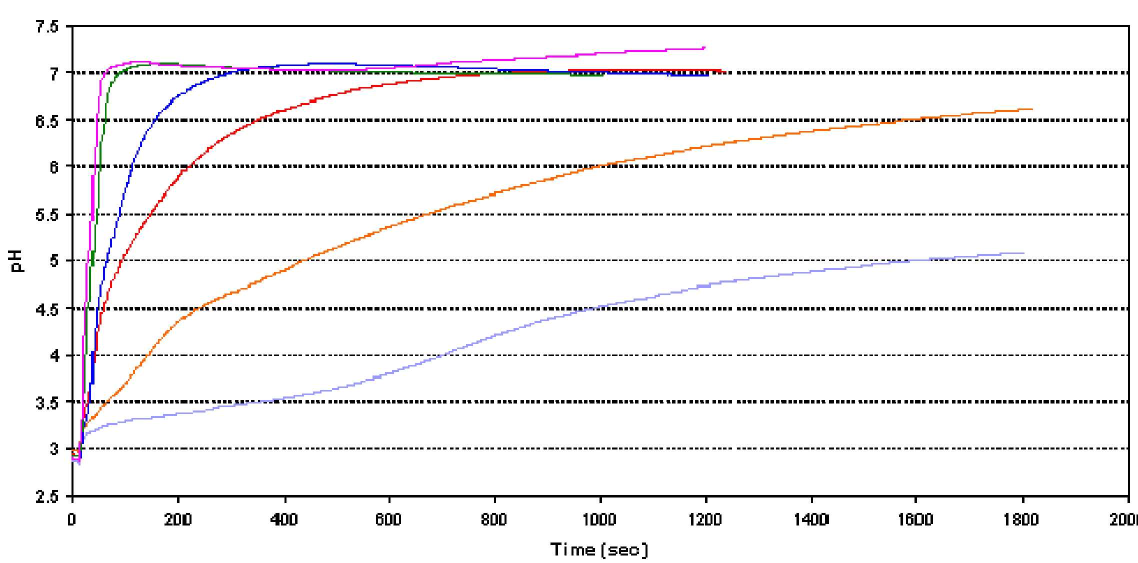
Figure 2 - Typical NaOH Neutralisation of Diluted Acid Sample (containing Fe^{2+})



With NaOH (& hydrated lime), the particle size of the precipitated hydroxides is unpredictable due to the rapid rate of the neutralisation reaction. The particles formed are often small (sometimes colloidal) making them difficult or impossible to settle or filter. The precipitates formed can also be voluminous and gel-like depending on the electrostatic conditions prevailing in the system.

The low reactivity and high buffering action of the HAPx formulations makes the end pH predictable and easily controlled. The slower rate of neutralisation allows the precipitate to build up to produce larger particle sizes. Figure 3 illustrates the control over the neutralisation reaction that can be exercised using this approach.

Figure 3 - Controlled Neutralisation Reactions Using Different Formulations



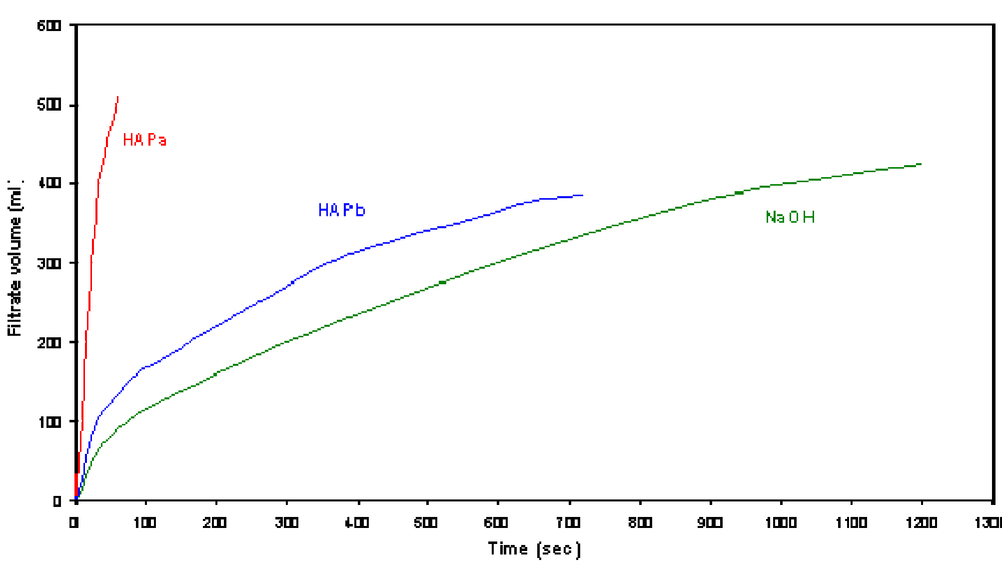
The coagulation and settling (and filtration) characteristics of precipitates also depend on the electrostatic interactions between particles. HAPx formulations can be *tuned* to the system to produce different results. Fast filtration with easily de-watered filter cakes of low volume are usually a requirement. Figures 4 & 5 show the filtercake produced and the internals of a filter press after the cake had been removed, when the system had been optimised for these parameters.

Figure 4: "Dry" filter cake arising from the filtration of hydrated ferric oxide.

Figure 5: Filter chamber after discharging filtercake, showing very little solid adhering to the filter cloth.

However, if the system contains other ions which have to be co-precipitated with the main precipitate, a more gelatinous precipitate which sweeps up these ions from the solution may be needed. The HAPx approach can control the nature of the precipitate formed. This can result in some *trade off* in filtration rates and filter cake qualities as depicted in Figure 6.

Figure 6 : Comparison of Filtration Rates for Different Treatments



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The advantages of the HAPx processes can be summarised as follows :-

1.The characteristics of the precipitates formed are such that they are easily and reliably filtered unlike most other processes which are used to precipitate hydrated metal oxides.

2.The process can be *tuned* to be very efficient. The good filtration rate and ease of removing the filter cake, make for quick filtration cycles, such that modest filter presses can be used to handle large batches of treated solution.

3.A consistent filter cake is produced which is of low volume, *dry* and with low soluble salt content if washed. It is amenable to a number of routes for disposal or re-use.

4.If desired, the precipitation conditions can be adjusted to co-precipitate other ions in solution.

5.The filtrate has minimal suspended solids, a near neutral pH (6-9) and very low (ppm) levels of metal ions in solution.

6.The HAPx reagents are economical, easily applied and do not involve any significant safety or environmental risk or hazard in their use, unlike sodium hydroxide and lime.