AQUAMAG®

Magnesium Hydroxide Slurry

A Safer Alternative to Caustic Soda

By Mark Shand

Caustic soda (sodium hydroxide) and lime are commonly used in the neutralization of acidic metal bearing industrial waste. Although these chemicals are usually the most common choice they do have some drawbacks when compared to magnesium hydroxide. One of these aspects is safety. Technical grade magnesium hydroxide suspensions are akin to pharmaceutical grade 'Milk of Magnesia' used to neutralize excess stomach acid. They are therefore safe and non-hazardous and will not cause chemical burns. Magnesium hydroxide has found great use in treating industrial metal laden acidic wastewater, where, compared with caustic soda or lime will produce less sludge volume, and a filtercake that de-waters more readily. Magnesium hydroxide also has the added advantages of having less chance of drastic pH swings than caustic soda, and can improve clarifier performance. It is also been recognized in the Municipal sector for pH and alkalinity control in nitrification, aerobic and anaerobic digestion. A relatively new application for magnesium hydroxide is in the area of hydrogen sulfide gas odor and corrosion control in municipal collection systems and wastewater treatment plants.

When comparing the physical and chemical properties of magnesium hydroxide with conventional alkalis, hydrated lime and caustic soda, see Table I, several differences are noted. The first is that fewer pounds of magnesium hydroxide are required to neutralize the same amount of acid, 37% more for caustic soda and 27% more for hydrated lime. Another unique characteristic, is the maximum pH obtainable during an overdosing situation. Excessive additions of caustic soda and hydrated lime will result in the pH of the waste stream reaching 14 and 12.5 respectively. However, due to the low solubility of magnesium hydroxide in water (0.009g/L), the pH of a magnesium hydroxide slurry is 10.5, and when used to neutralize acidic waste, will only obtain a pH of about 9.0, even when overdosed. This upper pH limit happens to coincide with the upper limit under the Clean Water Act, 1976.

As an example of the benefits of magnesium hydroxide, a large metal finishing operation located in Detroit, which operates zinc electroplating, chromate conversion coating, zinc phosphating and water bourne electroplating compared the use of magnesium hydroxide with caustic soda in their treatment plant. The effluent from the finishing process contains significant levels of dissolved zinc, iron and chromium, with minor levels of nickel, copper, lead, manganese and cadmium. The introduction of magnesium hydroxide significantly increased sludge particle density, improved filtration and produced better water quality. Tests showed that sludge volume was reduced by 60 percent. Filter press solids ranged from 27-50%, whereas with caustic soda they ranged from 15-30%. Settling rates were dramatically improved almost by a factor of ten times. Another benefit was the reduction of sulfuric acid usage caused by pH overshoots when using caustic soda.
Examination of the Material Safety Data Sheets for caustic soda and magnesium hydroxide will reveal some interesting differences. Magnesium hydroxide per SARA is a non-hazardous chemical. It is also not listed as a

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Examination of the Material Safety Data Sheets for caustic soda and magnesium hydroxide will reveal some interesting differences. Magnesium hydroxide per SARA is a non-hazardous chemical. It is also not listed as a hazardous substance under 6NYCRR part 597, unlike caustic soda. This eliminates the necessity of containment walls or dikes, special handling equipment, and can be stored safely anywhere. It requires no special safety equipment.

Property	50% NaOH	30% $Ca(OH)_2$	63% $Mg(OH)_2$
%Hydroxide	42.5	45.9	58.3
Solubility in Water g/100 ml	42	0.185	0.0009
Reactive pH	14	12.5	9.0
Freezing Point ^{o}F	61	32	32
Weight Equivalency	1.37	1.27	1

Table 1.

Magnesium hydroxide, unlike sodium hydroxide, is classified as a weak base, so it has no exothermic reaction with water. If splashed on the skin it can simply be washed off with no damage to the skin or required medical attention. Skin contact with concentrated caustic soda can cause serious chemical burns. If a large spill does occur, then clean up is achieved by pumping or shoveling up the material and land-filling, without the need of an environmental clean-up service.

In summary, magnesium hydroxide is a safe alternative alkali to use as a replacement for sodium hydroxide and is readily available in a 61% solids slurry.

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