



Storage and Handling of Magnesium Hydroxide Slurries

Introduction

This document is intended to provide general guidelines for users currently handling, or considering the application of magnesium hydroxide slurry. Every year millions of gallons of magnesium hydroxide slurry are shipped, stored, pumped and successfully applied.

Magnesium hydroxide slurry is an efficient, non-carbonate source of alkalinity. Because its solubility and reactive pH are low, it presents little or no hazard to people or to the environment. Milk of magnesia is a responsible, safe alternative to hazardous chemicals for those concerned with safety and the environment. It offers a wide range of application for acid neutralization and water treatment and often is the most economic alternative when all costs are considered.

However, if the user is unfamiliar with the characteristics and unique handling properties of slurries, proper application can be unnecessarily troublesome. Slurries are a suspension of finely divided solids. Inadequate mixing, improper piping and/or incorrect pump selection are the most common problem areas. The following includes recommendations and suggestions based on many years of experience handling magnesium hydroxide slurry. If after following these guidelines problems persist, Premier Chemicals can provide direct onsite technical assistance.

Tank Specifications

Magnesium hydroxide slurries must be shipped in containers that conform to the Department of Transportation classification 103W, 111A60W1 or 111A100W-1. These are 4000-gallon tank trucks (MC 303, 304, 306, 307) and 10,000 or 16,000-gallon tank cars constructed of mild steel, lined and unlined. All shipping containers must be inspected for cleanliness prior to filling. Dedicated magnesium hydroxide equipment is recommended but not always practical. For this reason, containers, unloading pumps, hoses and filters should be thoroughly inspected and flushed if necessary prior to loading. Cross contamination from residual products must be avoided to ensure proper slurry viscosity and stability.

Unloading

Tank trucks are unloaded by pumping or pressurizing the truck. A customer furnished pump or self-unloading tank truck equipped with its own pump can

speed the unloading process. When slurries are unloaded into tanks elevated more than 150 feet, the pumping method is preferred. The customer must provide a pump for unloading rail cars. The same rail car pump can also be used to recirculate the product into the neutralization or chemical process.

Ideally slurry deliveries to the storage tank should be filtered through a strainer with 1/8" holes. It is recommended that a strainer be included in the equipment design. When pump and valve inlet ports measure less than 1", an inline dual basket strainer will prevent plugging.

Storage Tanks

Carbon steel, fiberglass and poly are the preferred material for storage tanks and auxiliary equipment. Aluminum is not compatible with magnesium hydroxide slurry and is thus not recommended. ***Storage tanks should be installed, as close to the application as possible to prevent plugging.*** Vertical tanks are preferred over horizontal tanks since they take up less space, are more easily supported on concrete slabs and are simpler to agitate. In general, the tank should have a capacity of 1.5 times the required amount to accommodate the contents of the tank car or truck, plus rinse water.

Vertical tanks with a height/diameter between 1.0 and 1.2 are preferred. All tanks should be fitted with baffles set 90 degrees apart to prevent vortex formation during mechanical agitation. Baffles should measure 1/10th of the tank diameter and should extend to one foot above the floor of the tank, although this can vary with various tank configurations and agitators.

No special insulation is needed if the tank is located within a building that is heated above 40° Fahrenheit (4° Centigrade). If the tank is exposed to lower temperatures, it should be insulated and/or heated to prevent the slurry from freezing. Heat can be added by direct infusion of steam or by using electrical tape such as Chemelex on the exterior of the tank.

In outdoor applications with high ambient temperature, water mist nozzles located inside the tank can be used to prevent evaporative losses as well as for cooling. Slurry dilution from misting nozzles should be limited to 5% of the total volume.

Slurry Agitation

Some agitation is needed to keep solids in suspension while the slurry is in storage. This can be done by a top entering, pitch blade turbine or rake-type agitator. Agitator shaft speed will vary depending on the impeller size and length of shaft. Top mounted agitators offer greater efficiency (using less horsepower) and ease of service.

Below are the horsepower requirements for agitators used in cylindrical tanks that have a 1:1 height to diameter ratio:

| | |
|---------------------------|---------|
| Slurry concentration..... | 50-65% |
| Pounds per gallon..... | 12-13.4 |
| HP/1000 gal..... | 0.7 |

Agitators need not be operated continuously, and provisions can be made for intermittent operation down to 1 hour in every 3 hours. Short periods of shutdown due to power outages will not adversely affect the slurry, but four to eight hours of continuous agitation should follow such incidents. Longer shutdowns should be avoided, but if they are unavoidable sparge with air around the agitator's propeller before restarting. This will help reduce the power surge on restarting. Agitator manufacturers can provide advice on the proper selection of suitable equipment.

Piping

Seamless carbon steel piping is adequate for most applications. A variety of other piping materials are suitable, including PVC and reinforced rubber hoses. Whenever possible, piping should be installed above ground and with easy access for servicing.

All process pipes must be heated and/or insulated if they are located in areas where temperatures are extreme. (Below 32° F or above 95°F.) This can be done using self-regulating heating tape, such as Chemelex, or its equivalent. Steam tracing is not recommended. High temperatures can dry magnesium hydroxide onto the walls of tanks and pipes.

It is important to maintain adequate velocity through all piping to prevent plugging. Branch runs to metering pumps should be supplied by a continuous recirculation loop wherever possible. Piping should be horizontal or below the valve or pump entrance. This configuration discourages magnesium hydroxide particles from settling in the valve or pump entry port. Since friction and pressure loss in slurry pipelines are higher than those of water, a minimum pipe diameter of 1.25 times the discharge size of the pump is recommended. Suction lines from the storage tank to the feed pump should be kept as short as possible. Suction lines should be at least two times the size of the suction of the pump being used. Minimum pump or valve inlet diameter is ½”.

The storage tank discharge and feed pump inlet must be located less than three feet of one another. Piping from the tank and pump should be installed in the following manner: From the storage tank start with a close nipple, valve, close nipple, tee, nipple (one foot or less), pump, close nipple, tee then continue with discharge piping. On the tee's install a close nipple and ball valve for water flushing.

Process Valves

Plug, full port ball and pinch valves allow straight-through flow and a larger port to minimize turbulence and pressure loss. This reduces the potential for solids to collect. Minimum valve size is ½", however 1" is preferred.

Drain Valves

Ball valves are preferred over gate valves due to their decreased potential for plugging.

Flow Control Valves

Pinch-type control valves are recommended. These valves close positively even with solids present in the tube.

Pumps

Slurry pumps fall into two general categories, centrifugal pumps and positive displacement pumps. Centrifugal pumps have the highest capacity and are useful when pumping large volumes of slurry, recirculating loops, or where high pressures and metering are not required. Centrifugals together with control valves are often used for a wide variety of slurry applications. Discharge from the recirculating loop should be installed in the following manner. From a tee in the recirculating line, use a close nipple then the control valve followed by as short discharge line as possible.

For applications requiring metering or high pressures, positive displacement pumps such as peristaltic or progressing cavity pumps are recommended. Check the manufacturer's specifications for maximum rpm's and recommendations for pumping abrasive slurry. Solids concentration and viscosity will have a direct impact on pump component life. Progressing cavity pumps cannot be operated dry. For this reason, peristaltic or hose pumps are often preferred. Peristaltic pumps must be the type filled with a lubricant. Natural rubber is the preferred hose and lining material.

All major pump and valve manufacturer's can provide assistance with product selection for pumping and controlling magnesium hydroxide.

Maintenance

Handling a slurry requires some routine maintenance. All slurries have a tendency to settle and plugging is generally a sign of incorrect equipment or piping configurations. Correct installation of the storage and feed system will reduce plugging and system maintenance.

Routine inspection of the storage tank for leaks and cleaning of material built-up on the sidewalls should be performed weekly! Pumps and mixers should be regularly checked for proper operation.

Flushing of the suction and discharge lines should be scheduled as needed. When flushing from the pump to the tank through the discharge line, be careful not to add too much water. Excess water will affect the stability of all slurries and cause faster settling.

On new installations inspect the pump on a monthly basis for wear. This will prevent leakage and feed problems. It will also help determine the replacement schedule for the hose or stator.