WHITE PAPER

Limestone and Marble Chips vs Magnesium Hydroxide Pellets

Acidic Condensate pH Modification Treatment Products

HVAC and HOT WATER INDUSTRY

Limestone and Marble chips should not be used as an active ingredient for the pH modification of acidic condensate produced by Boilers, Hot water heaters, Furnaces, Stack economizers, and Flue gas condensate drains.

Limestone and marble chips have been used for many years now for the modification of pH levels in aqueous solutions. Many of these applications using Limestone for pH control have been in systems where there is plenty of soak time for the exchange of hydrogen Ions (H+) and Hydroxide Ions (OH-). In the HVAC and Hot Water industry we are now producing equipment that is so highly efficient to the point that we are condensing the flue gases on the fireside and creating an Acidic liquid which can range from 1.9 to 3.8 pH. We have found through our **eleven** years of testing that the average ph level with good quality combustion is about 3.2 pH and at that level you are producing a **strong acid.**

Now let us go back to the statement **"Soak Time"**, this is very important for those using limestone or marble chips as their active ingredient to control pH levels. The more soak time and more surface area of the chips a better control of the pH level can be achieved. **There is just one problem with this scenario, we do not have soak time in our industry unless one grossly over sizes a containment tank which is not cost effective and uses a much larger foot print.**

Whether using an inline tube or a tank to modify pH levels, when our equipment is operating the acidic condensate is always flowing at gallons per hour.

Take for example a 4,000 MBH boiler that is condensing, it can produce up to 32 GPH of acidic condensate and a 6,000 MBH condensing boiler can produce up to 48 GPH. On average our equipment will produce .75 GPH for every 100,000 BTU input @ 93% efficiency.

There are several problems using 100% limestone and marble chips for pH modification in a flow situation.

1. No guarantee to treat an acidic stream 3
2. The reaction of acid and limestone creates an insoluble calcium salt which coats the chips making them useless.
3. The higher the percentage of Calcium Carbonate content in the limestone chips the more calcium salt is produced thus coating the chips. Some claim this percentage is an advantage but it is clearly **NOT**.
4. There are several papers online about not using Limestone or Marble chips for pH control of flowing aqueous acid solutions. Many of these articles are written by wastewater industry people.
5. **It is more probable then not you will have damage to drains, grates, pipes, septic systems, the environment, and violate local-national codes when using 100% limestone or marble chips in an aqueous acidic flowing stream.**

Magnesium Hydroxide Pellets are produced by adding water to a magnesium oxide powder in a controlled manner using a pelletizing machine. As the pellets start to form and get larger the pellets are like a snow ball running down hill, the pellets adds layer after layer of Magnesium Hydroxide to the seed pellet.

The process continues as the pellets are placed into steel drums. After about twenty minutes they reach a temperature of nearly 250F thus steaming off most of the water and leaving behind a semi hard pellet which we call **“pH Power Pellets™”.**

Now why is this better method for treating acidic condensate in a flowing stream over using limestone? Well let’s start with the magnesium oxide and magnesium hydroxide; both of these products are the main ingredient for products like Milk of Magnesia ®, Rolaids®, Tums®, and other antacids.

YOU WON’T FIND LIMESTONE LISTED AS AN ACTIVE INGREDIENT BUT MAY FIND CALCIUM CARBONATE LISTED. OF COURSE IT IS IN A POWDER FORM NOT A HARD ROCK FORM.

PH control is also the main use for Magnesium Hydroxide (Strong Alkali) in all MSDS and SDS sheets found in the chemistry industry today.

These pellets work so well that most European manufactures have been using them since condensing equipment first came to the market. As the acidic aqueous solution flows over and around the **pH Power Pellets™** the exchange of OH- and H+ ions takes place quickly due to the semi hard pellet structure unlike the hard rock structure of limestone and marble chips.

Being layered pellets, as the acid wears out the top layer you end up with a brand new next layer. The pellets will eventually dissolve leaving behind a sandy like matter which is environmentally safe.

It is so safe that: “It also takes part in the Biorock method of building Artificial Reefs.”[1]

“Magnesium Hydroxide powder is used industrially as a NON-HAZARDOUS alkali to neutralize acidic wastewaters.”

We have tested every “Neutralizer” using 100% limestone or marble chips being sold in our HVAC industry today and the results have been extremely poor. Most of the products completely fail (pH under 5.0) within 30 hours of operation. Now consider the number of heating hours in your area and not to mention the year round domestic hot water production.

As an example in Burlington, Vermont over a 30 year period the NOAA has determined that the city has an average seasonal degree Days of 7,665 with hours of equipment heating at 319.9, this will produce 239.53 gallons of acidic condensate in an average season based on 100,000 BTU input. Our test results show that a contractor would have to replace or refill a limestone chip product 10.63 times during the heating season in Burlington, VT. Now also consider the pH level of the condensate being produced, the level is controlled by two factors:

1. Percentage of Sulfur in the gases
2. Combustion quality

The **pH Power Pellets™** will last 7-10 times longer than limestone or marble chips*

*Test results produced by **JJM**™ Boiler Works, Inc. Laboratory using acidic condensate from SS vessels, Copper-Fin secondary heat exchangers, Furnaces, and Stack drains from a CSA® Certified laboratory.

George Carney is responsible for the content of this article and has made every effort to be accurate in its content.

George can be reached at:

JJM™ Boiler Works, Inc.

413-527-1893 Office

413-527-2122 Fax

413-427-3373 Cell

www.jjmboilerworks.com

References:

1. Wikipedia “Magnesium Hydroxide”
2. Wikipedia “Magnesium Hydroxide”
3. Digital Analysis Corporation “pH adjustment systems”