

EFFECT OF SULPHITES AND SULPHATES IN SLAKING WATER ON TOTAL NEUTRALIZATION CAPACITY OF LIME SLURRY

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The negative impact of Sulphites or Sulphates in water used for lime slaking has been known in the industry for a long time. It is a well-documented fact that the sulphite content of over 500 PPM in slaking water will retard the temperature rise in slaking and results in a coarser particle of hydrated lime in the slurry.

The purpose of this paper is investigate what impact the lower slaking temperature and coarser particle size of hydrate has on TNC (Total Neutralization Capacity) of lime slurry slaked with water containing Sulphates or Sulphites. To decide the impact we must first decide the end use of the hydrated lime slurry. There are two major use of hydrated lime slurry that we address in this paper;

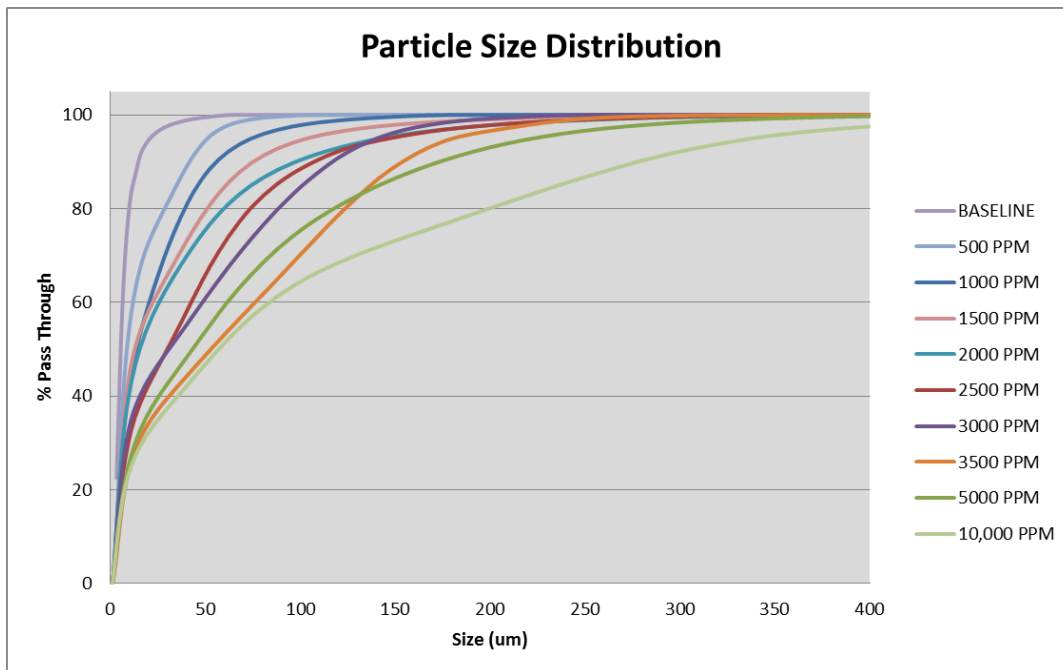
- Air pollution FGD (Flu Gas Desulphurization)
- Acid Water Neutralization in Mining (AMD)

FLU GAS DESULPHURIZATION

As stated above, sulphite content of slaking water will cause coarse particles of hydrated lime. The coarse particles have smaller surface area thus less area of contact with flue gas to neutralize gas. Further, the contact time between lime slurry and flue gas is typically less than 10 seconds. This results in increase lime consumption. Unreacted lime particles are captured by the dust filters. In flue gas desulphurization the contact time between the hydrated lime and flue gas in the reactor is far too short for proper utilization of hydrated lime with coarse particle size.

The graph below shows the impact of Sulphates in slaking water on particle size of slaked lime.

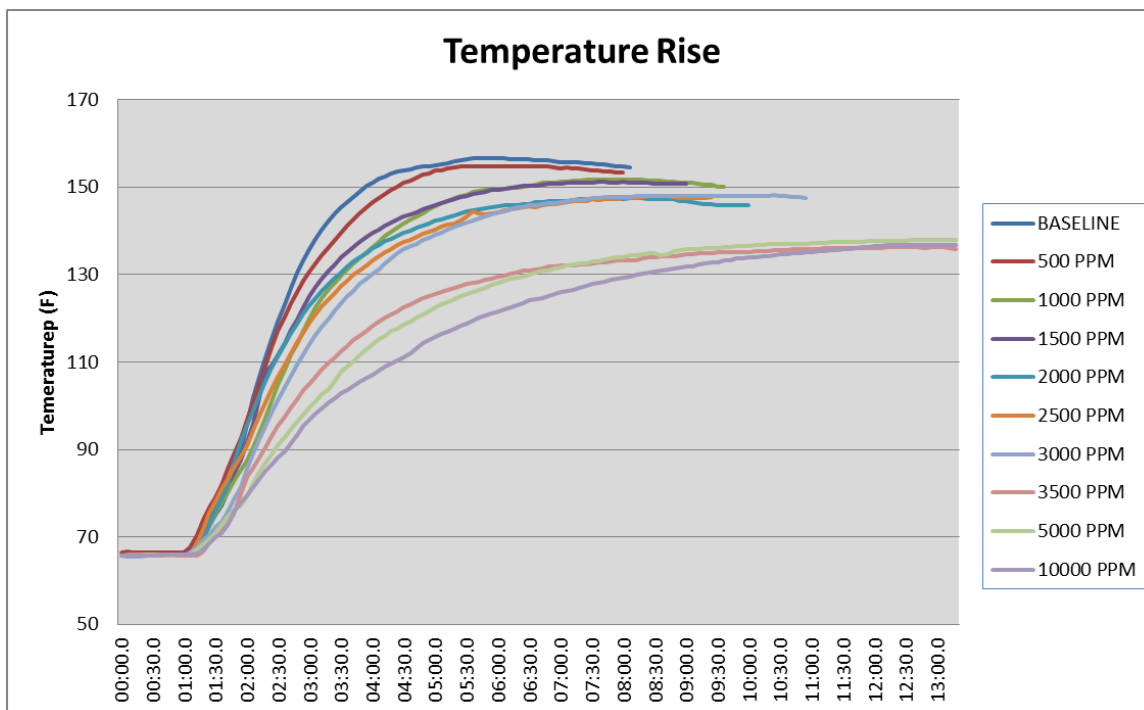
GRAPH 1



As the sulphate content of slaking water increases the particle size of hydrated lime in the slurry increases. This increase of particle size reduces the total surface area for contact for neutralization, therefore more contact surface between the lime slurry and acid media is needed for efficient neutralization.

Graph 2 shows the impact of Sulphates in slaking water on slaking temperature rise for various Sulphates content.

GRAPH 2



The graph shows that as sulphate content of slaking water increases, the temperature rise of slaking decreases. This temperature retardation results in coarser particles of hydrate. In addition the more sulphate content of slaking water, the longer it takes to complete the hydration.

ACID NEUTRALIZATION (AMD)

To determine the impact of Sulphates in slaking water, where the hydrated lime slurry is used for neutralizing acid water, in industrial processes or mining operation, additional tests were performed. These tests were performed by an independent laboratory using ASTM C-1318, to determine the Total Neutralization Capacity (TNC) of lime slurry produced by slaking water containing different PPM of Sulphates. The following is the laboratory report showing the results of tests performed. Each test was done more than once to confirm repeatability.



Carmeuse Lime & Stone-Technology Center

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August 12, 2014

To: Julia Mercer
From: Eric Schons

RFS: 14-116 Chemco 2nd Round of TNC Slurry Testing

Summary

Carmeuse provided a sample of Beachville lime to Chemco for lab testing regarding poor quality slaking water. Twelve lime slurry samples were sent to the Technology Center. Each sample contained a different quantity of sulfate in the slaking water. The Total Neutralizing Capacity (TNC) was analyzed by following ASTM 1318.

The TNC test was developed to measure the neutralizing contributions from lime, calcium hydroxide, magnesium hydroxide and magnesium oxide. Ground lime is slaked then titrated with hydrochloric acid maintaining a pH of 6 for 30 minutes. The acid consumption is calculated as CaO and reported as TNC (%).

The test samples were received as slurries. A representative specimen was obtained by mixing each container on an overhead stirrer while drawing off a portion of slurry to dry in a laboratory oven overnight at 120 °C. Since the solids are already hydrated, the slaking step was not needed so room temperature carbon dioxide-free water was added to each weighed sample immediately prior to analysis.

Table 1 below shows the summary of the results.

Data

Sample ID	Lab ID	% Solids (Oven Dried)	TNC (%)
0	14-2239	26.23	71.11
1	14-2240	25.20	71.33
2	14-2241	26.38	71.83
3	14-2242	25.15	71.39
4	14-2243	26.23	69.36
5	14-2244	24.76	69.79
8	14-2245	22.55	70.77
10	14-2246	25.37	66.97
Properly slaked (1)	14-2309	14.79	68.81
Poorly slaked (2)	14-2310	13.67	69.04

The following are the sample ID referred to in the above report.

Sample 0 = Distilled water no Sulphates

1 = 1000 PPM of Sulphate

2 = 2000 PPM of Sulphate

3 = 3000 PPM of Sulphate

4 = 4000 PPM of Sulphate

5 = 5000 PPM of Sulphate

8 = 8000 PPM of Sulphate

10 = 10,000 PPM of Sulphate

The TNC (percent) is impacted by the percentage of solids in the slurry as well as non-lime impurities. In addition tests results are subject to minor variations due to measurement tolerances during tests.

CONCLUSIONS

The above tests results clearly show that sulfite or sulfate content of slaking water will negatively affect temperature rise in the slaking process resulting in a coarser particles of hydrate with smaller specific surface. The higher the sulfite or sulfate content of slaking water the more pronounced the negative impact on slaking.

In practice the impact of slaked lime with slaking water containing sulfates or sulfites, on neutralization of acid, is not directly correlated with the PPM of sulfates or sulfites, content of slaking water. The neutralization capacity of the lime slurry is directly affected by the contact time between the slurry and acid medium.

The shorter the contact time the less neutralization efficiency of slurry with sulfite content will be very low.

In mine acid water neutralization due to long contact time of ½ hour or more, the impact of the sulfites or sulfates are virtually negligible on efficiency of neutralization of the lime slurry. The long contact period will result in 100% usage of the $\text{Ca}(\text{OH})_2$ in the lime slurry. In mine acid water neutralization the sulfate content of slaking water will have virtually no impact on the neutralization efficiency of the lime slurry.