Article

THE SIX FUNDAMENTAL FACTORS OF LIME SLAKING

The aim of the slaking reaction is to produce a slurry containing calcium hydroxide particles with high surface areas. Because particles with higher surface areas are more highly reactive, such slurries are more efficient in the end-use process, creating the required result from the minimum input of lime.

WHAT'S IMPACTING YOUR LIME SLURRY QUALITY?

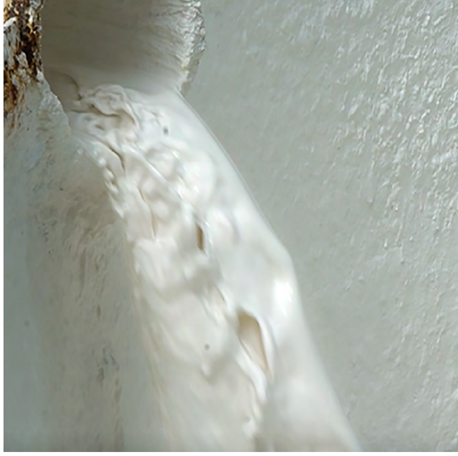
There are six main factors that impact the slaking process and, therefore the quality of the lime slurry:

1. Slaking temperature
2. Slaking water temperature
3. Slaking water chemistry
4. Slaking residence time
5. Slaking agitation
6. Steam control

SLAKING TEMPERATURE

Of these, **slaking temperature** is perhaps the most important, as it directly influences the particle size of the hydrated lime—and, therefore the reactivity of the slurry. Simply put, the closer the slaking temperature is to the boiling point of water, 212°F (100.0°C), the finer the particle size, the greater the surface area, and the more reactive the slurry. Ideally, it should also not exceed this temperature so as to avoid boiling over the slaker.

In detention and ball mill slakers, we would typically expect a slaking temperature between 175°F and 185°F (79.4°C and 85.0°C); in paste slakers, the slaking temperature is generally slightly hotter at between 185°F and 195°F (85.0°C and 90.6°C). Additionally, when using quicklime, hotter slaking temperatures can reduce the total time required to complete the slaking reaction as illustrated in Figure 1.



WATER TEMPERATURE

Slaking temperature itself is a function of the water-to-lime ratio, the quality of the quicklime, heat transfer efficiency within the slaker, and the slaking water temperature—the second fundamental factor of lime slaking. Particular challenges arise when using cold water (<70°F/21.1°C) in the slaker, as it makes it difficult to reach the required slaking temperature. This results in a less reactive slurry (due to coarser hydrated lime particles), as well as producing significantly more waste product (known as grit or residue). Figure 2 illustrates the increase in residue.

Not only must this additional grit be disposed of properly, it may also contain quicklime, resulting in the waste of valuable product. To avoid these issues, we typically recommend a slaking water temperature of between 70°F and 90°F (21.1°C and 32.2°C), and the use of a water preheater when the water falls below that.

WATER CHEMISTRY

The **chemistry of the slaking water** also has an impact. Water with a high concentration of sulfates and sulfites (>1000ppm) can cause delays in the slaking rate, as well as issues around the slaking temperature and wasted quicklime. High levels of phosphates can similarly impact the slaking process, although are generally less detrimental to the process. The third factor to watch in slaking water chemistry is hardness, which can result in scaling and may necessitate the use of a water softener.

When possible, we recommend using potable water, which typically contains low levels of the problematic chemistries. When water chemistry is an issue—for example, when process water needs to be recycled as part of zero liquid discharge regulations—the use of a ball mill slaker may be the most practical solution, since these are not as sensitive to the issues caused by high sulfate/sulfite and/or phosphate concentrations as other slaker types.

A final note about water chemistry: while the chemistries discussed above pose problems when slaking lime, other chemistries are more benign. For example, the pulp and paper industry benefits from high salt concentrations in its slaking water (particularly anions of chlorides and fluorides). These have a slight catalytic role on the slaking reaction, as well as increasing the boiling point, thereby allowing higher slaking temperatures.

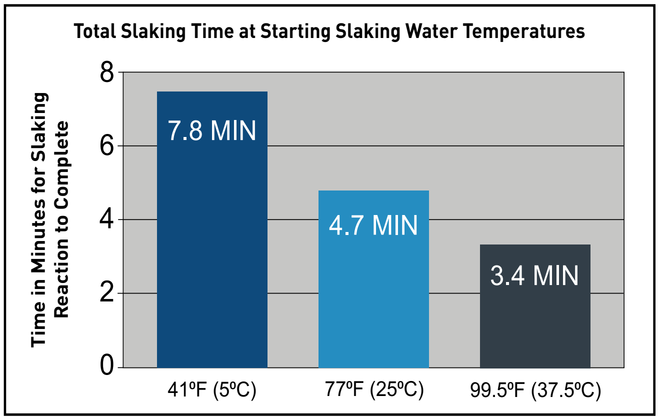


Figure 1

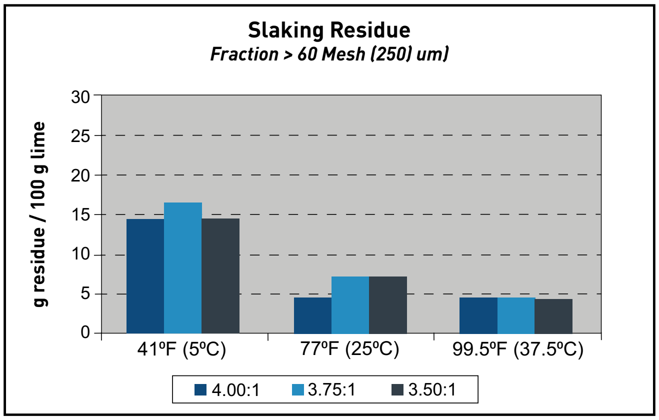


Figure 2

RESIDENCE TIME

Slaking residence time is a factor to consider when using a continuous slaker (detention, ball mill and paste). As quicklime constantly moves through these types of slaker, it is important to ensure the quicklime spends enough time in the slaker to complete the slaking reaction. Typically, North American quicklimes will require at least three minutes of residency time to completely react, although some slower-reacting quicklimes may need double that time or longer. If the residency time is too short, the quicklime may continue to react as it passes through the grit removal system, which may cause safety issues and potential blockages (particularly when a grit removal screen is used)[1].

SLAKING AGITATION

A related issue arises with improper **slaking agitation**. A poorly mixed slurry will not react well, reducing slaking speed and delaying the slaking reaction. To avoid this, regular, proactive maintenance is required on the agitation device, whether that be mixing paddles or agitators in the case of detention, paste and batch slakers, or the ball mill media in a ball mill slaker. In the case of paste slakers, proper mixing is also needed to mitigate against the risk that localized hotspots (i.e., above boiling point) will develop in the slurry.

STEAM CONTROL

The final factor to impact lime slaking is **steam control**. The slaking reaction will generate significant amounts of steam, which needs to be removed from the slaker in a controlled fashion. If not controlled effectively, steam will naturally migrate through the path of least resistance—which tends to be up the dry quicklime feed systems and into the silos. Here it will quickly degrade the quality of the quicklime, may cause handling issues—including blockages—and may result in significant scale build-up inside the silo. Steam that escapes into the surrounding work environment also poses a safety risk to personnel, as well as creating issues around cleanliness and housekeeping.

Current best practice is to use draft-induced scrubber boxes that use a water spray to quench the steam and scrub it of any lime dust. The water and lime dust are then returned to the process, helping to reduce lime waste and avoid environmental contamination.

STILL HAVE QUESTIONS?

Carmeuse Systems has the expertise in handling all forms of lime across diverse industries and applications. To help ensure your lime systems are achieving peak performance, contact our team of experts.

[1] It is important not to overload the slaker, as this reduces the effective residency time.

YOUR LIME HANDLING EXPERTS™

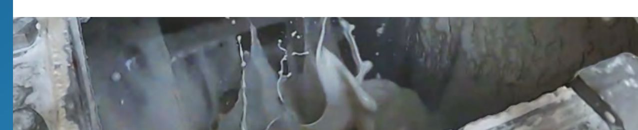
Carmeuse Systems is your trusted partner for designing, integrating, and upgrading lime handling systems. As part of the Carmeuse Group, our teams have unrivaled expertise in understanding the role of lime handling equipment within your operation. From selecting the appropriate raw material, to system engineering, enhancements, and maintenance, our teams provide End-2-End support and guidance. We make complex projects seem simple and help our customers every step of the way.

CARMEUSE

Carmeuse is your trusted partner from source to solution with our End-2-End Services offering providing raw materials, freight & logistics support, and lime handling systems. Every step of the way, we go above and beyond to make things simple for our customers and we have the expertise to help in whatever you may need from choosing the correct raw material to maintaining your lime system.

PLEASE CONTACT US VIA EMAIL OR PHONE AND WE CAN RECOMMEND A PRODUCT TO BEST MEET YOUR NEEDS.

salesinquiries@carmeuse.com
1-866-780-0974



All data shown is for illustration purposes only. Actual product specifications can vary based on several different factors. Carmeuse does not warrant or guarantee the accuracy of the above-referenced data, and will not be liable for any loss or damage arising out of the use thereof. The information contained herein is offered for the user's consideration, examination, and determination of suitability.

CARMEUSE
11 Stanwix Street, 21st Floor
Pittsburgh, PA 15222
www.carmeuse.com