GLYBase™

SODIUM GLYCOLATE

THE BETTER BASE

The Science of a Beautiful Base

Enabling Precision pH Control in AHA Systems

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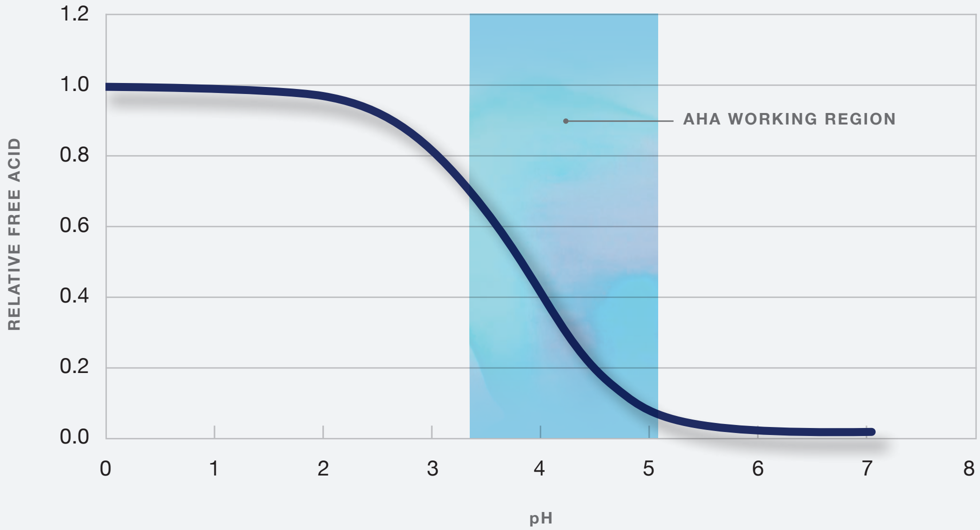
The Science of a Beautiful Base

In AHA-based formulations, pH functions as the defining parameter governing chemical activity and product performance. The equilibrium between protonated (free acid) and deprotonated glycolic acid determines exfoliation efficiency, skin compatibility, and regulatory positioning. As established in acid–base equilibrium theory, pH directly controls free acid content and therefore performance.

Because of this chemical sensitivity, achieving a target pH is not sufficient; the formulation process must ensure absolute precision. Small deviations impact both clinical efficacy and the user experience. Formulators require a neutralization strategy that moves beyond bulk adjustment to provide high-resolution control.

Figure 1 Free Acid vs pH (Conceptual)

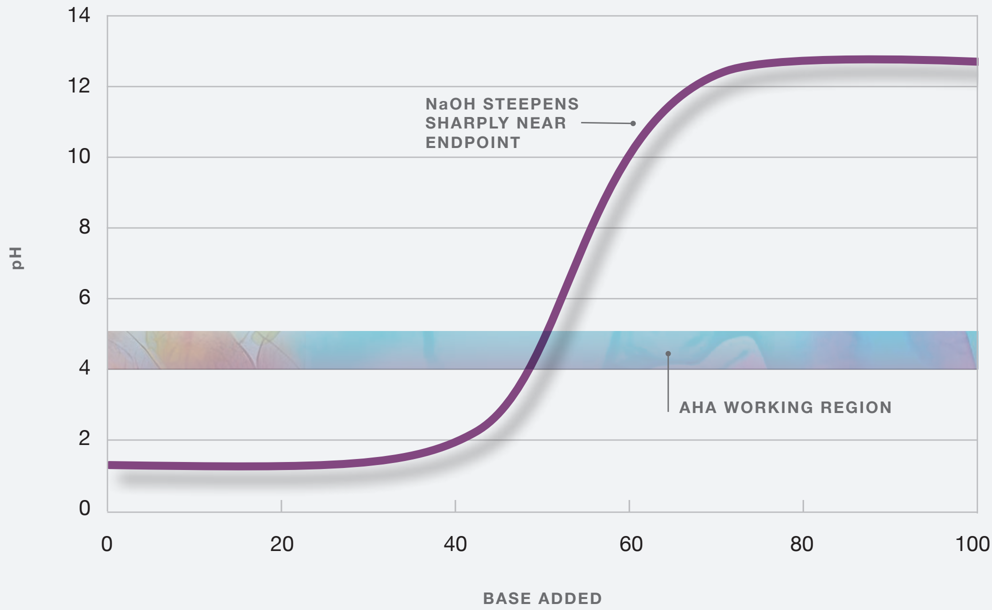


The Performance Gap

The relationship between pH and free acid concentration is nonlinear. Small shifts in pH produce significant changes in protonated glycolic acid within the functional formulation range. This sensitivity is most acute within the “AHA Working Region,” typically between pH 3.5 and 5.0.

Within this range, even a marginal deviation can fundamentally alter the formula’s profile. For example, in a 6% AHA system, a pH overshoot from 4.0 to 4.1 results in approximately a 10% reduction in free acid concentration **(FIGURE 1)**.

Figure 2 NaOH Titration Behavior
(Sigmoidal titration curve)

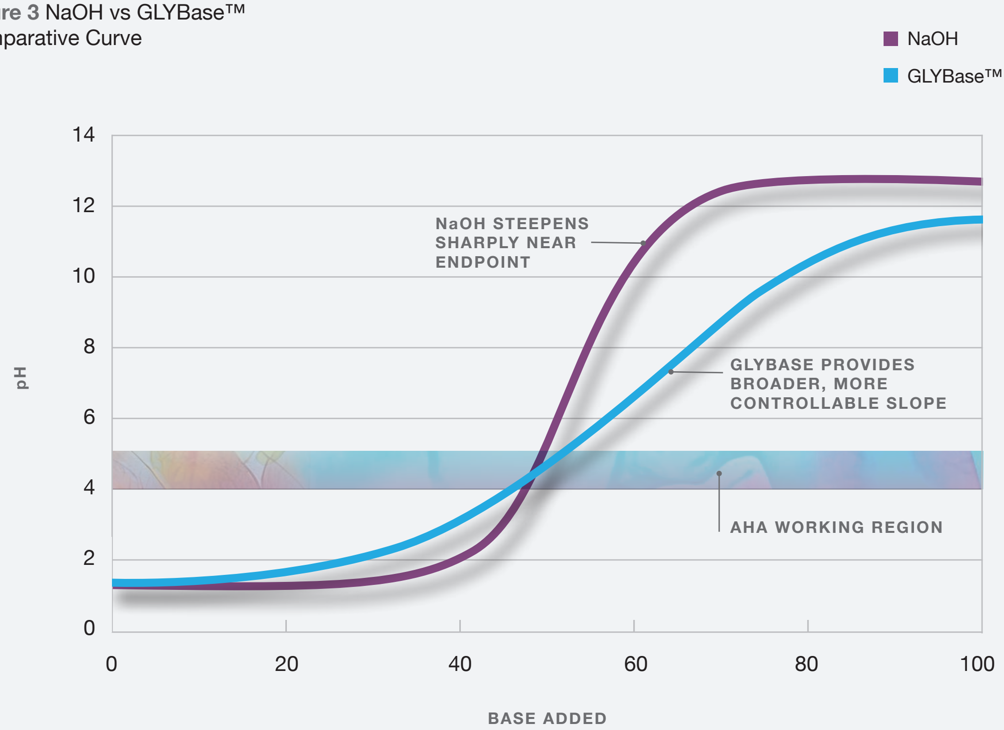


The Origin of the Problem

The titration of glycolic acid with sodium hydroxide (NaOH) follows a classical sigmoidal curve characteristic of weak acid–strong base systems. At low pH, the system is dominated by protonated acid and changes occur gradually. However, as the system approaches the target pH, buffering capacity diminishes and the system becomes increasingly sensitive to base addition.

This results in a rapid change in pH per unit addition of base, observed as a steep increase in the titration curve **(FIGURE 2)**. For AHA formulations operating between pH 3.5 and 5.0, small additions of NaOH produce disproportionately large changes in pH, reducing the ability to make fine adjustments.

Figure 3 NaOH vs GLYBase™ Comparative Curve

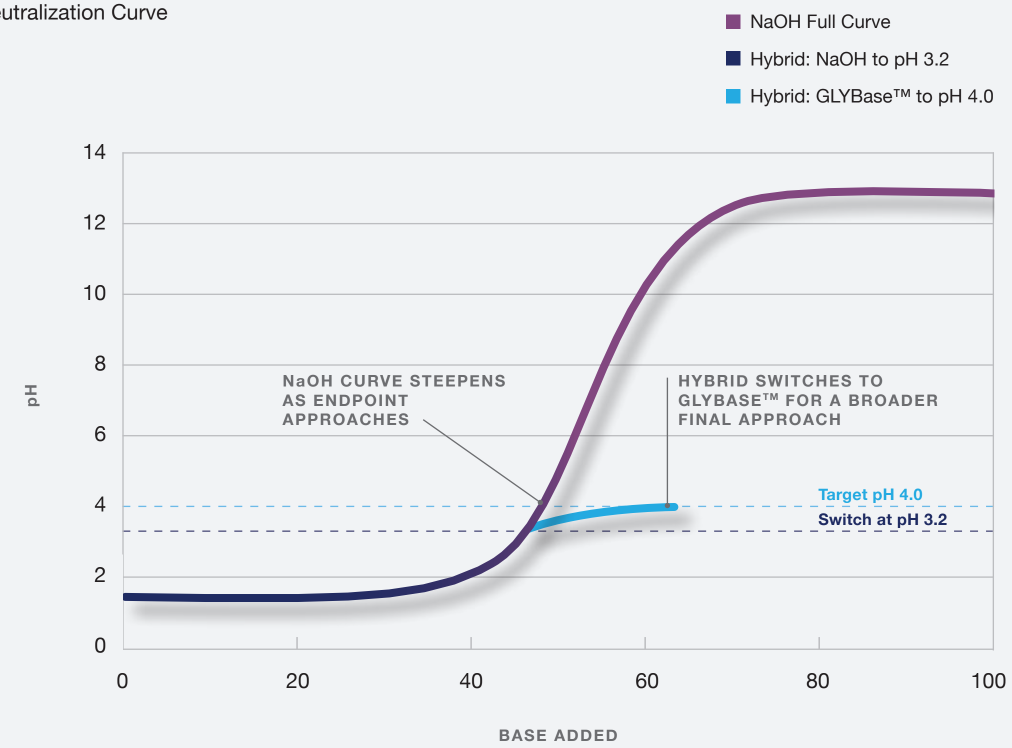


Finer, Predictable Control

Sodium hydroxide is efficient for rapid bulk neutralization but lacks the resolution required for final adjustment. Near the endpoint, NaOH transitions from an effective tool to an imprecise one. Incremental additions often result in large, unintended shifts in pH, requiring iterative correction steps **(FIGURE 3)**.

Internal testing validates the superior resolution of **GLYBase™**. While NaOH-buffered solutions demonstrate a rapid rate of change with a slope of 0.084, solutions using **GLYBase™** exhibit a significantly gentler slope of 0.014. Because the rate of pH change is nearly eight times greater in NaOH solutions, **GLYBase™** provides formulators with much finer, predictable control.

Figure 4 Hybrid Neutralization Curve



The Final 10% Strategy

GLYBase™ (high purity sodium glycolate) introduces a buffered adjustment mechanism. As the conjugate base of **GlyAcid®**, it operates within the same acid–base equilibrium system rather than overwhelming it. This allows for a more gradual pH shift compared to NaOH **(FIGURE 4)**.

Rather than replacing NaOH, **GLYBase™** is most effective as part of a two-stage hybrid approach:

- Bulk Neutralization: Use NaOH to rapidly bring the formulation to approximately pH 3.0–3.2.
- Precision Adjustment: Utilize **GLYBase™** for the final adjustment to the target pH.

Long-Term Formulation Reproducibility

The hybrid approach delivers practical advantages: precise targeting, reduced overshoot risk, and improved batch-to-batch reproducibility. Because **GLYBase™** is chemically aligned with the glycolic acid system, it integrates seamlessly without introducing competing chemistry. This strategic alignment ensures that the chemical profile remains consistent through scale-up and commercial production.

By utilizing a buffered mechanism for final adjustment, formulators achieve superior resolution where precision is most critical. This process transformation ensures that product performance is stabilized and reproducible from the laboratory bench to the consumer shelf.

NaOH sets the pH. **GLYBase™** perfects it.

References

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