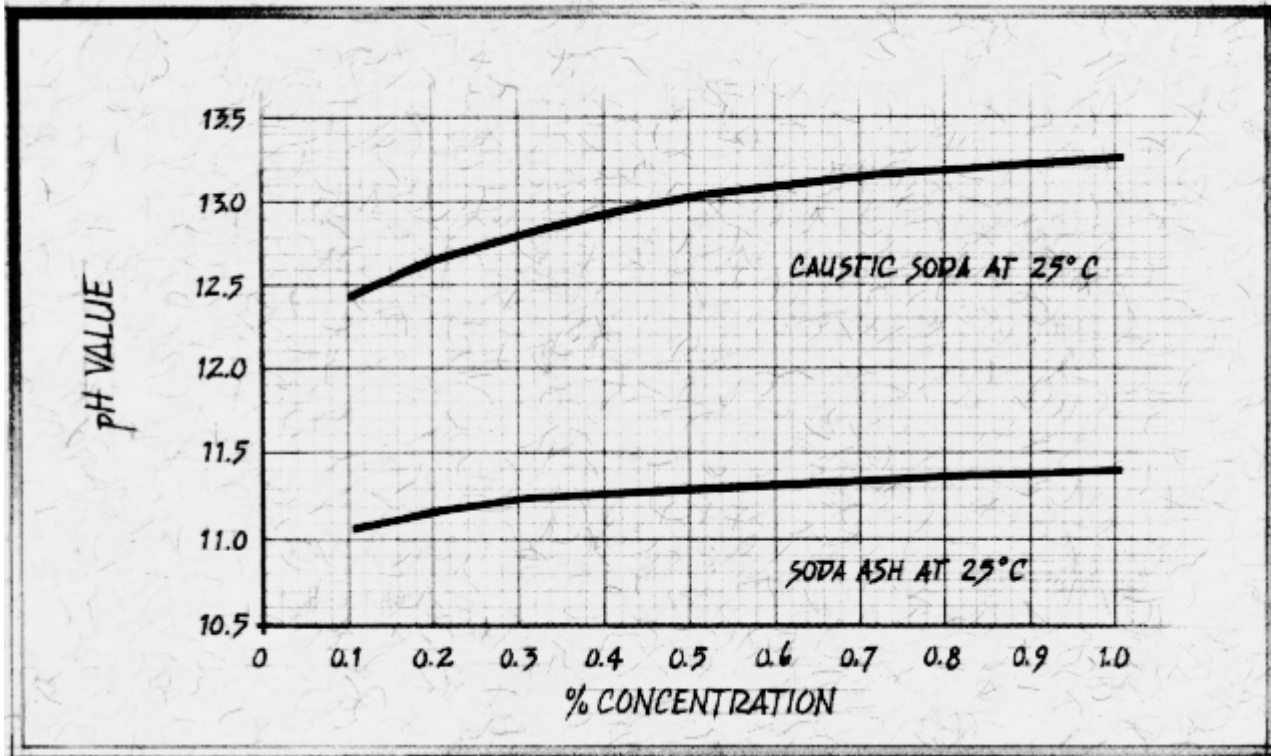


PH Adjustment / Acid Neutralization

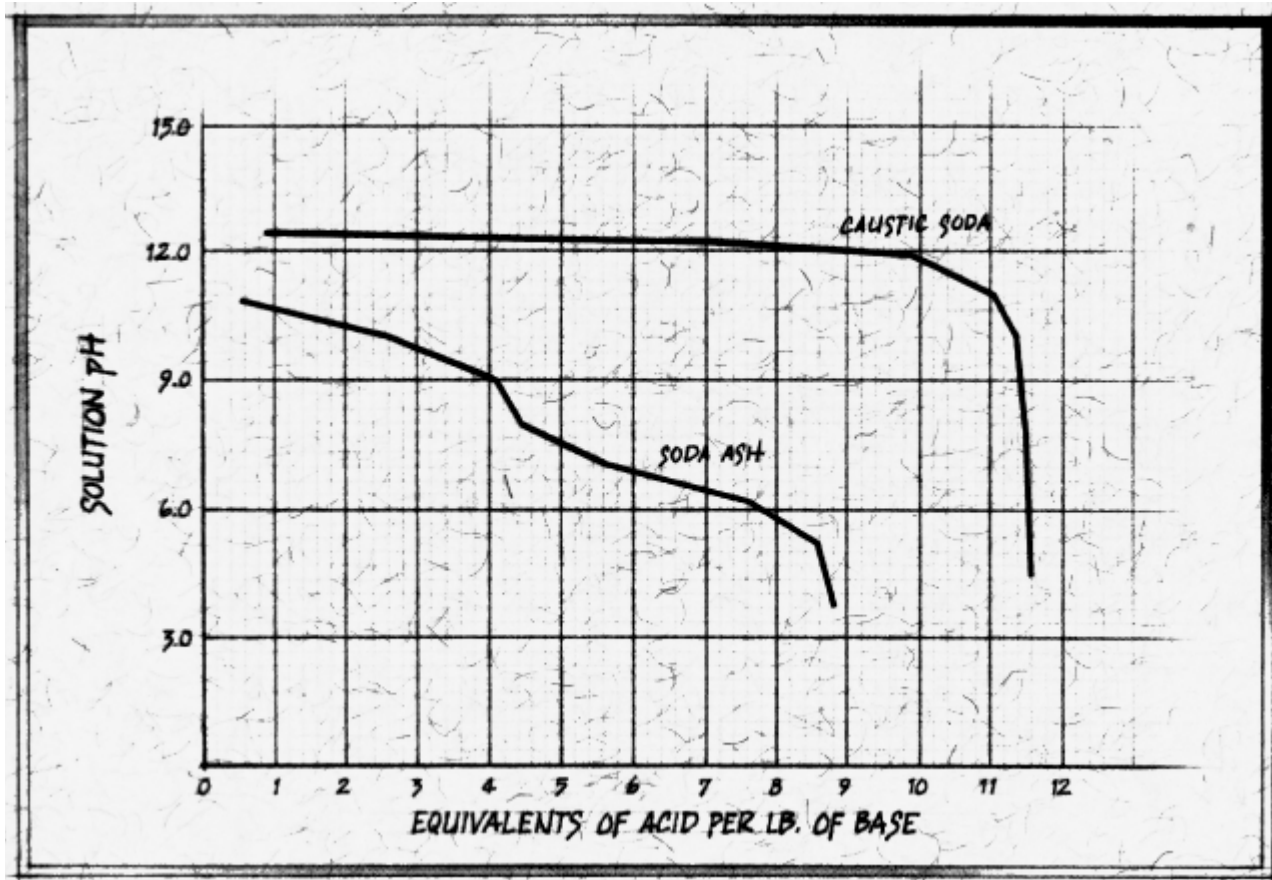
Soda Ash is used to regulate pH in many chemical process streams. The superior buffering capacity of soda ash versus caustic soda offers advantages in certain and plant wastewater pH ranges. The following graph depicts the pH of various concentrations of soda ash solutions.



PH Values of Solutions of Alkali Products

Soda ash is also used to neutralize acid as shown in the following graph.

Acid Neutralization Capacity



Sodium Chemicals Manufacture

Soda ash provides the sodium source for the manufacture of many sodium salts including sodium phosphates, sodium sulfate, sodium sulfite, sodium acetate, sodium nitrite, sodium silicate and sodium citrate. When replacing caustic soda

in such applications, a weight ratio of 1.325/1 of soda ash to caustic soda must be used because of the lower sodium oxide (Na_2O) content of soda ash.

Kraft Pulping

The use of soda ash for alkali make-up in the kraft pulping process is well known. Instead of adding caustic soda to the white liquor, soda ash is added to the green liquor. Soda ash use in this application requires that the caustization equipment and lime kiln have sufficient excess capacity to handle the increased quantities of sodium carbonate.

In evaluating the economic feasibility of soda ash for alkali make-up it is important to consider the additional lime kiln energy costs in addition to the, delivered cost of soda ash versus caustic soda. Keeping in mind this application will require 1.325 times as much soda ash as caustic soda.

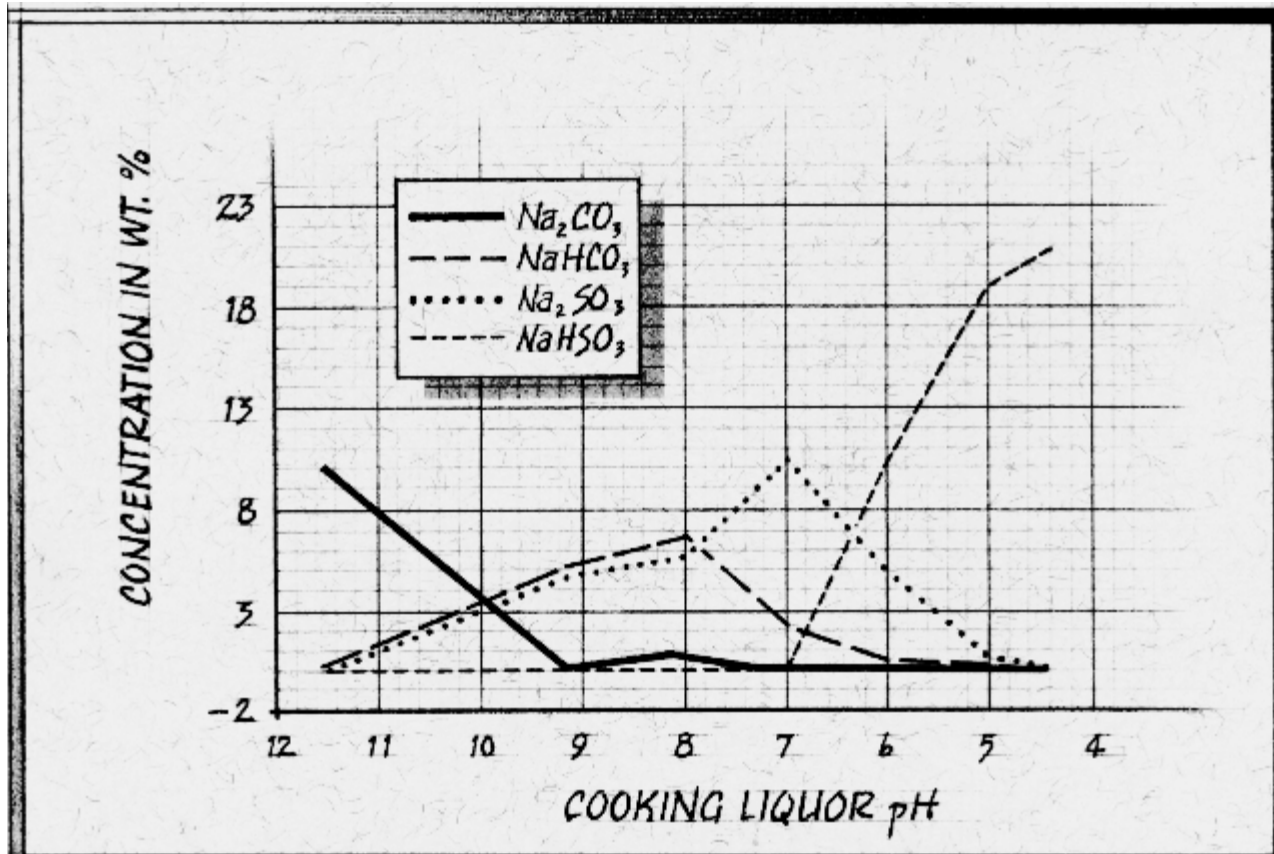
Other Pulp and Paper Applications

Soda ash is used as the sodium source for sodium sulfite/bisulfite pulping liquors used in the sulfite, CMP, and

CTMP processes, and in NSSC pulping. The following graph (PIC3) shows the mixture of

products at various pH levels when soda ash is reacted with sulfur dioxide.

Sodium Sulfite Production from Soda Ash and Sulfur Dioxide



It is also possible to replace a portion of the caustic soda in many pulp bleaching applications such as caustic extraction or hydrogen peroxide bleaching of mechanical or chemical pulps. However, the higher pH requirements of these applications may necessitate the continued use of some caustic soda.

Flue Gas Desulfurization

In solution form, soda ash is used to remove sulfur dioxide (SO_2) from flue gas streams in wet scrubbers. In addition, soda ash is effective in removing H_2S . Again, this application will require 1.325 times as much soda ash as caustic soda.