Hydroxide Solutions
Sodium & Potassium

Properties & Hazards Information

Presentation Overview

- **General Information**
  - Physical & Chemical Properties
  - Health Hazards

General Information

Hydroxide Solutions – Sodium & Potassium

Common Applications

Sodium Hydroxide

- Rayon and nylon production
- Textiles
- Pulp and paper
- Foods and pharmaceuticals
- Metals (especially aluminum)
- Photographic products
- Water and wastewater treatment
- Many other organic and inorganic products
- pH adjustment

Sodium Hydroxide Basics

NFPA Diamond

UN Placard

GHS Pictogram

Common Applications

Potassium Hydroxide

- De-icing fluids
- Agriculture (fertilizers, herbicides)
- Alkaline batteries
- Photo chemicals
- Food additives (low sodium requirements)
- Soaps and detergents
- Potassium carbonate
- Phosphates
- Sodium substitute

Potassium Hydroxide Basics

NFPA Diamond

UN Placard

GHS Pictogram

Properties

Physical & Chemical

General Information

Physical Properties

Sodium Hydroxide

- Could be called:
  - Sodium Hydroxide = NaOH = Caustic Soda = Caustic = Lye = Caustic Lye
- Solution
  - Hazy to clear and colorless.
  - Spills dry “white.”
- Solid
  - White, crystalline solid.

Physical Properties

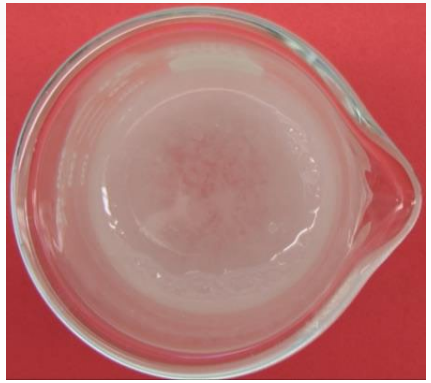
Density – Sodium Hydroxide

- 50% Solution
  - 12.7 pounds/gallon at 60° F
- 30% Solution
  - 11.1 pounds/Gallon at 60° F
- 20% Solution
  - 10.65 pounds/gallon at 60° F

Physical Properties

Freezing points – Sodium Hydroxide

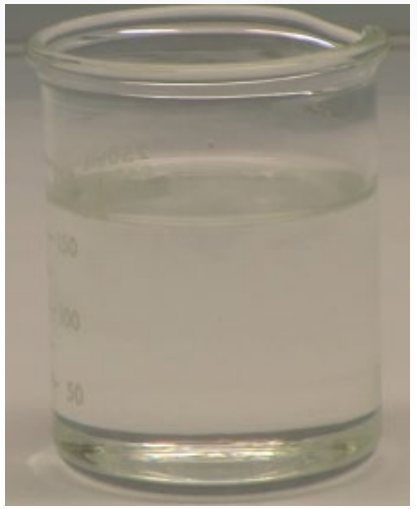
- 50% Solutions
  - Freeze at 52° F (11° C).
  - Crystallization begins below 65° F (18° C).
- Diluted Solutions
  - Freezing points will vary by concentration.
    - 20% solution will freeze at approximately -18.4° F.
    - 30% solution will freeze at approximately 32° F.



Physical Properties

Potassium Hydroxide

- Names
  - Potassium Hydroxide = KOH = Caustic Potash.
- Solution
  - Clear
  - Spills dry “hazy clear.”
- Solid
  - Clear/slight haze.



Physical Properties

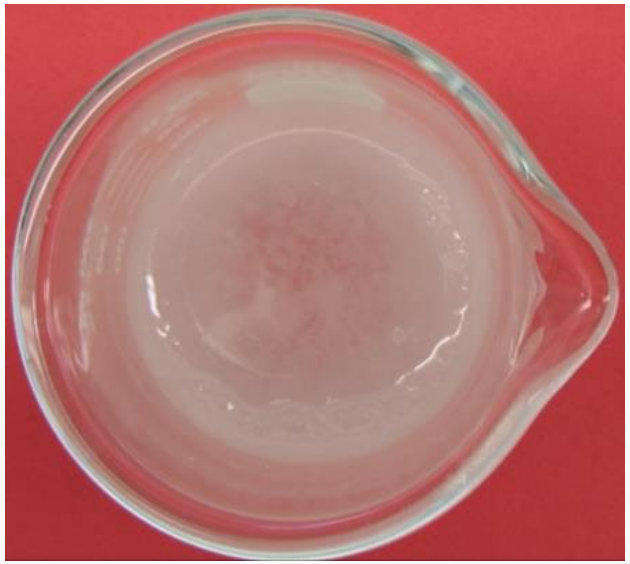
Density – Potassium Hydroxide

- 50% Solution
  - 12.15 pounds/gallon at 60° F
- 45% Solution
  - 12.0 pounds/gallon at 60° F

Physical Properties

Freezing points – Potassium Hydroxide

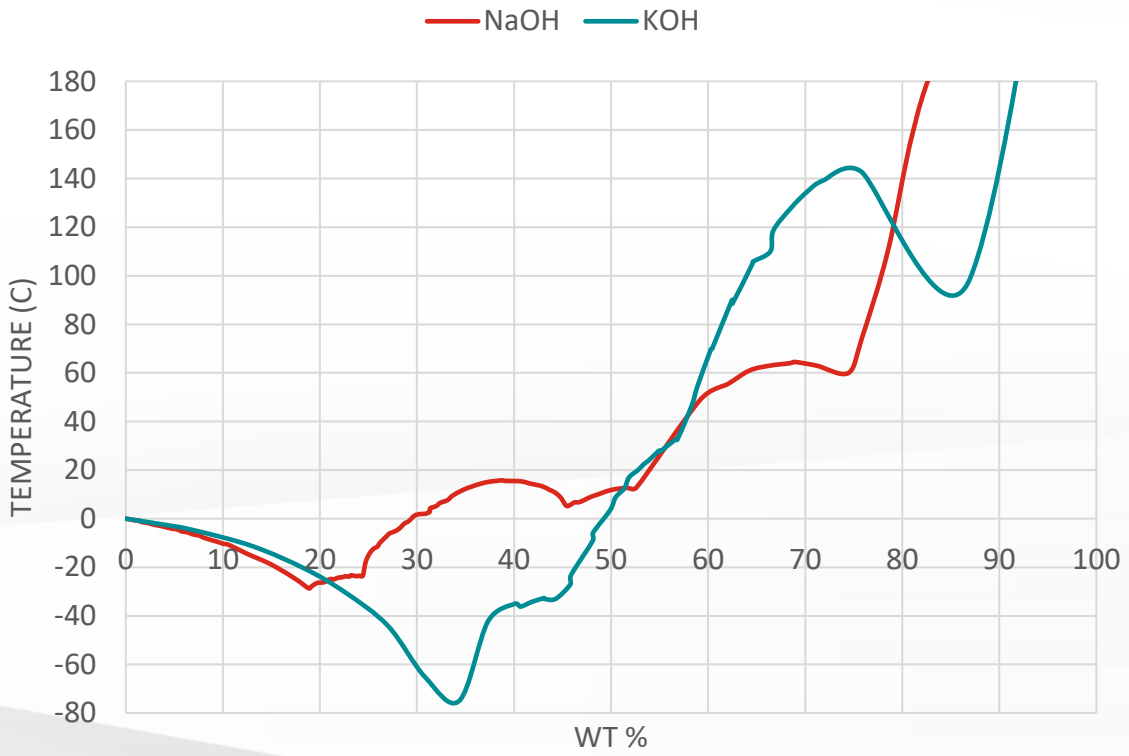
- 50% Caustic Potash Solution
  - Freeze at 36° F (2° C)
- 45% Caustic Potash Solution
  - Freeze at -22° F (-30° C)



Physical Properties

Freezing Point Comparison

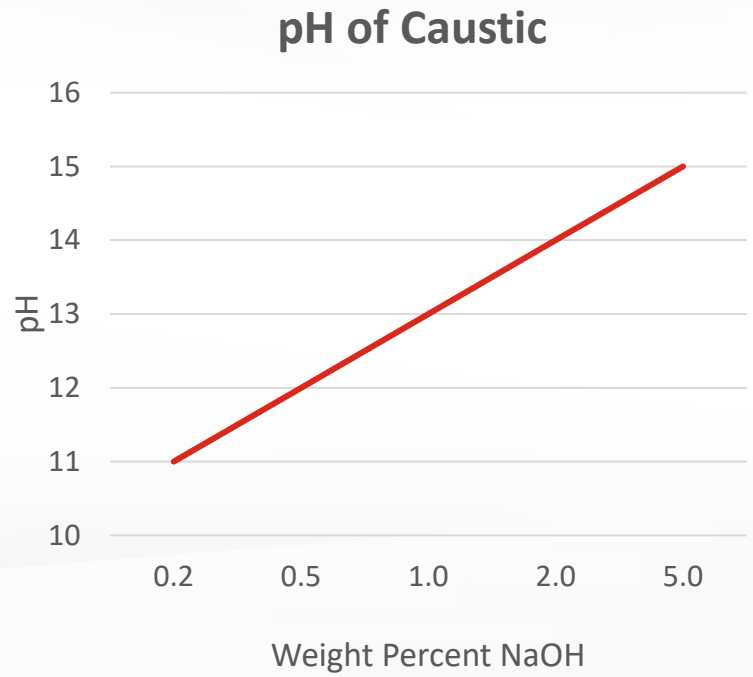
Sodium and Potassium Solutions



Chemical Properties

pH

- Caustic is a strong base.
  - 3.7% caustic solution: pH = 14
  - 0.1% caustic solution: pH > 11
  - Water (neutral): pH = 7



Chemical Properties

Dilution

- Highly exothermic.
  - To prevent:
    - Splattering.
    - Dangerous mist.
    - Surface eruptions.
  - ALWAYS:
    - Add caustic to water.
    - Add caustic slowly.
    - Mix or circulate to dissipate heat and hot spots.

Chemical Properties

Reactivity

- **Keep separate from acids.**
- Avoid other reactive materials:
  - **Nitrogen-containing organics** - can lead to the formation of shock-sensitive salts or the release of ammonia gas
  - **Phosphorous** – forms phosphine (colorless, flammable, toxic gas).
  - **Peroxides** –vigorous exothermic reaction generating heat and oxygen gas.
  - **Some hydrocarbons** – mixed with alkynes releases hydrogen gas.
  - **Some metals (esp. Aluminum, Copper, Zinc, Tin)** – hydrogen (flammable gas) and corrosion
  - **Leather –** reacts with the protein and fat molecules within the leather, leading to a weakening of its structure.

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What Are Hydroxide Solutions?

Health Hazards

General Information

Health Hazards

- **Sodium/Potassium Solutions** are strong, corrosive alkalis and attack:
  - Eyes
  - Skin
  - By inhalation
  - By ingestion

Health Hazards

Eye exposure

- Sodium/Potassium Hydroxide solutions:
  - Cause immediate pain, severe burns, and corneal damage, which may result in blindness.

Health Hazards

Recommended treatment for eye exposure

- Wash hands before touching face or eyes.
- Flush with running water for at least 15 minutes, preferably until seen by a medical professional.
- Hold eyelids apart to ensure rinsing of the entire eye surface and lids.
- DO NOT attempt to neutralize with chemical agents.
- Seek advice for treatment immediately.

Health Hazards

Skin exposure

- Sodium/Potassium Hydroxide solutions:
  - May cause deep and severe burns.
  - Burns may not be immediately painful as pain may be delayed for minutes or hours.

Health Hazards

Recommended treatment for skin exposure

- Flush with running water for at least 30 minutes.
- Remove contaminated clothing.
- DO NOT attempt to neutralize with chemical agents.
- Seek advice for treatment immediately.

Health Hazards

Inhalation

- Sodium/Potassium Hydroxide solutions:
  - Mists/dry residue may cause irritation to the nose, mouth, throat, and lungs.

Health Hazards

Recommended treatment for inhalation

- Remove victim from area.
- If breathing is difficult, oxygen may be beneficial.
- If breathing has stopped, administer artificial respiration.
- Seek advice for treatment immediately.

Health Hazards

Ingestion

- Caustic Soda/Caustic Potash:
  - If ingested, may cause severe pain, burning of the mouth, throat, and esophagus, vomiting, diarrhea, and possible death.

Health Hazards

Recommended treatment for ingestion

- DO NOT INDUCE VOMITING.
- Rinse mouth.
- Give large amounts of water.
- If vomiting occurs spontaneously, keep airway clear.
- If person is unconscious, do not administer anything by mouth.
- Seek advice for treatment immediately.

Questions?