Sodium Hypochlorite

Properties & Hazards Information

Presentation Overview

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

General Information

Sodium Hypochlorite

Common Uses

- Disinfection/sanitizing
  - Drinking water and wastewater
  - Cooling towers
  - Swimming pool treatment
  - Restaurants, hospitals, and food processing equipment
- Elimination/control
  - Quagga and zebra mussels
  - Mold, fungus, and algae
- Bleaching
  - Laundry
  - Pulp and paper

NOTE: Product must be a registered pesticide for disinfection/kill claim applications.

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Sodium Hypochlorite Basics

NFPA Diamond

UN Placard

GHS Pictogram

Additional Information

Solutions are commonly called:

- Hypo
- Bleach
- Liquid Bleach

Acceptable

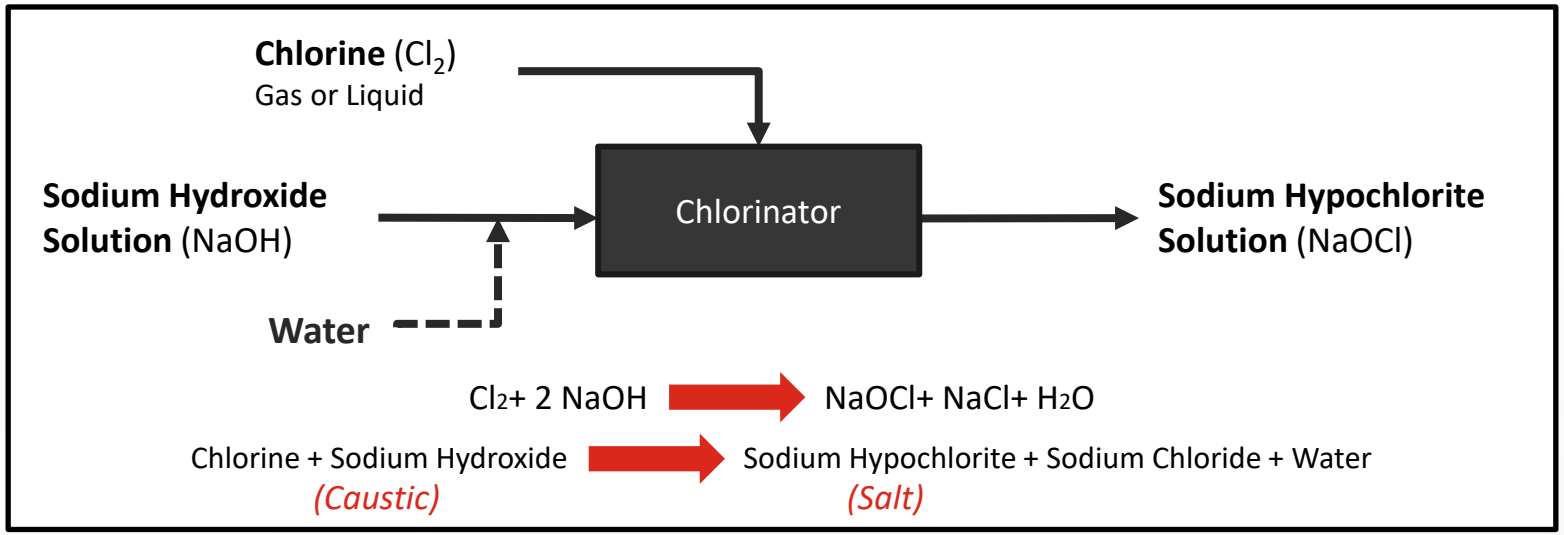
Should NOT be called:

- Chlorine
- Liquid Chlorine

Using these terms is very confusing to others, especially Emergency Response Personnel.

Manufacturing Process

Sodium Hypochlorite (NaOCl) is a solution made from reacting Chlorine with a diluted Sodium Hydroxide (caustic) solution.



Properties

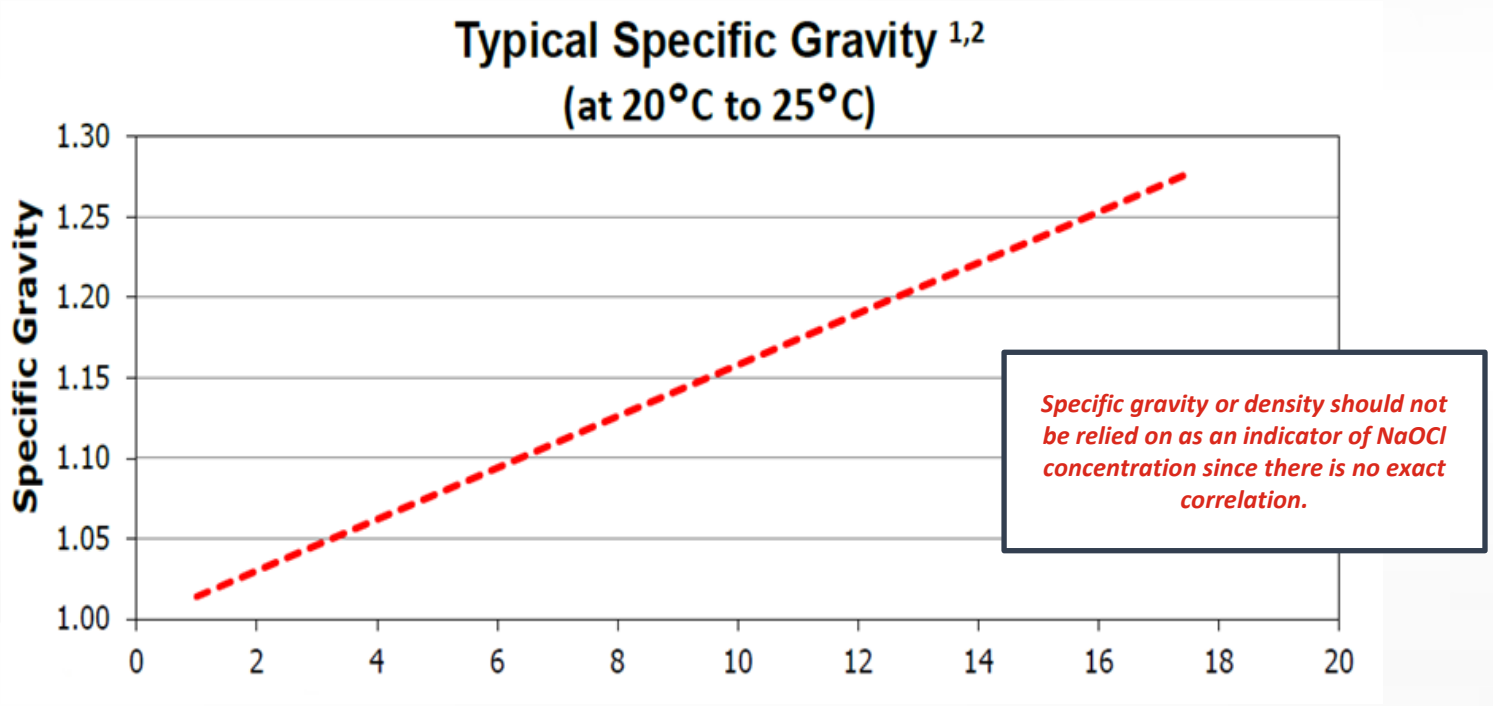
Physical & Chemical

General Information

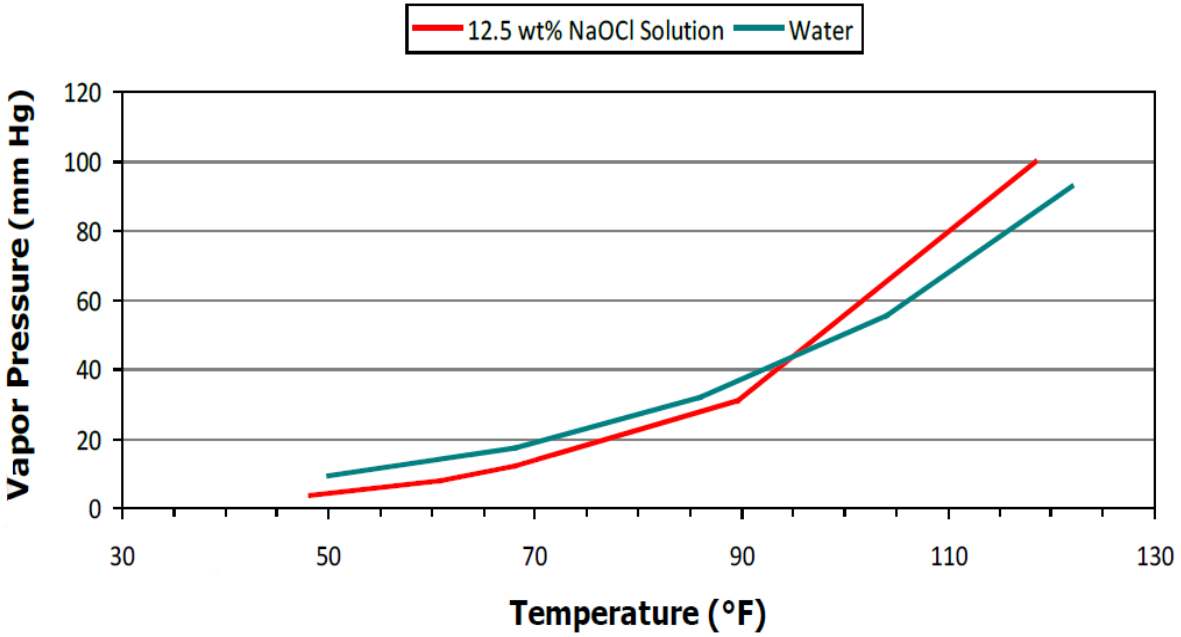
Physical Properties

- Yellow-green to pale green liquid.
  - Contamination can tint solutions.
- “Chlorine” type odor.
  - Generally thought to be hypochlorous acid.
- Soluble in water.
- Stable
- Similar to water (i.e. color, smell, density, physical attributes, etc.) in lower concentrations.

Specific Gravity



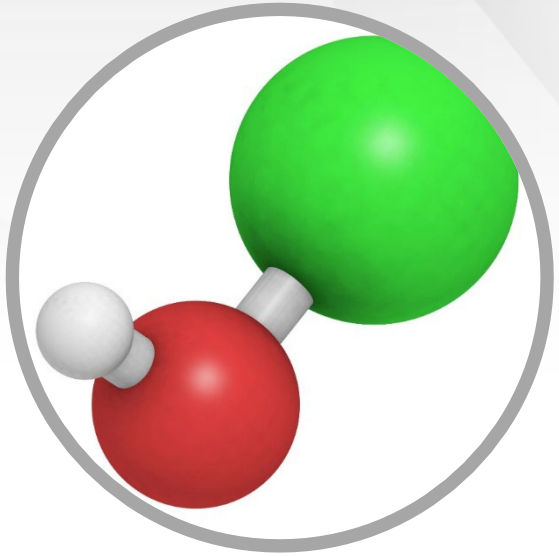
Vapor Pressure



The vapor pressures of Sodium Hypochlorite Solutions are not significantly different than water. Above 90° F, there is more potential for "chlorine" odor.

Based on data from Pamphlet № 96, Ed. 4, October 2011, The Chlorine Institute

Chemical Properties



Reactivity	Decomposition	Stability
• Oxidizer/Highly Reactive • Corrosive	• Chemistry • Concentration	• Metals • Temperature • Alkalinity/pH Effect

Chemical Properties

Oxidizer/Highly Reactive

- Sodium Hypochlorite (NaOCl) is **not** compatible with:
  - Oxidizers, acid, reducing agents.
- Organic compounds/materials:
  - Oils, greases, fuels, solids.
  - Rags, wood fibers, paper.
- Nitrogen-containing compounds:
  - May generate chlorinated nitrogen compounds.

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Chemical Properties

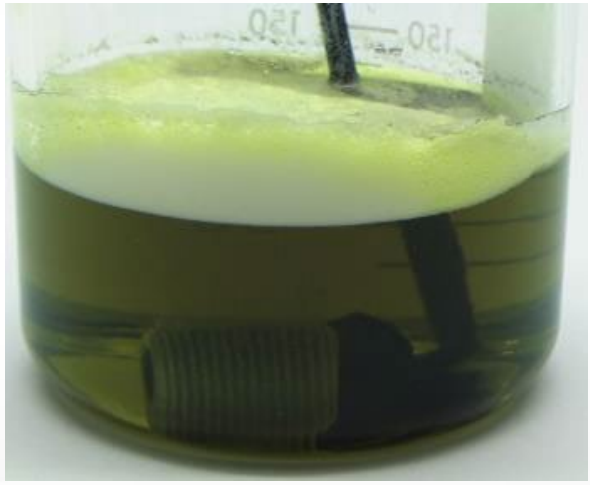
Oxidizer/Highly Reactive

- Sodium Hypochlorite (NaOCl) is not compatible with:
  - Solid or dissolved metals such as copper, nickel, or cobalt.
  - Most metals and their alloys, act as catalyst for the decomposition.
  - Iron solids if present as iron oxide.

Chemical Properties

Stability

- All hypochlorite solutions decompose over time.
- Dissolved metals will catalyze the decomposition of NaOCl.
  - Common metals: Nickel, Copper.
  - Iron (when present as an oxide) increases the decomposition rate of NaOCl.
- Decomposition of NaOCl solutions caused by trace metals can produce significant quantities of oxygen gas.



Chemical Properties

Stability

- Sodium hypochlorite is an oxidizer and is highly reactive.
- Contact with any acid or acidic compound will liberate chlorine gas.

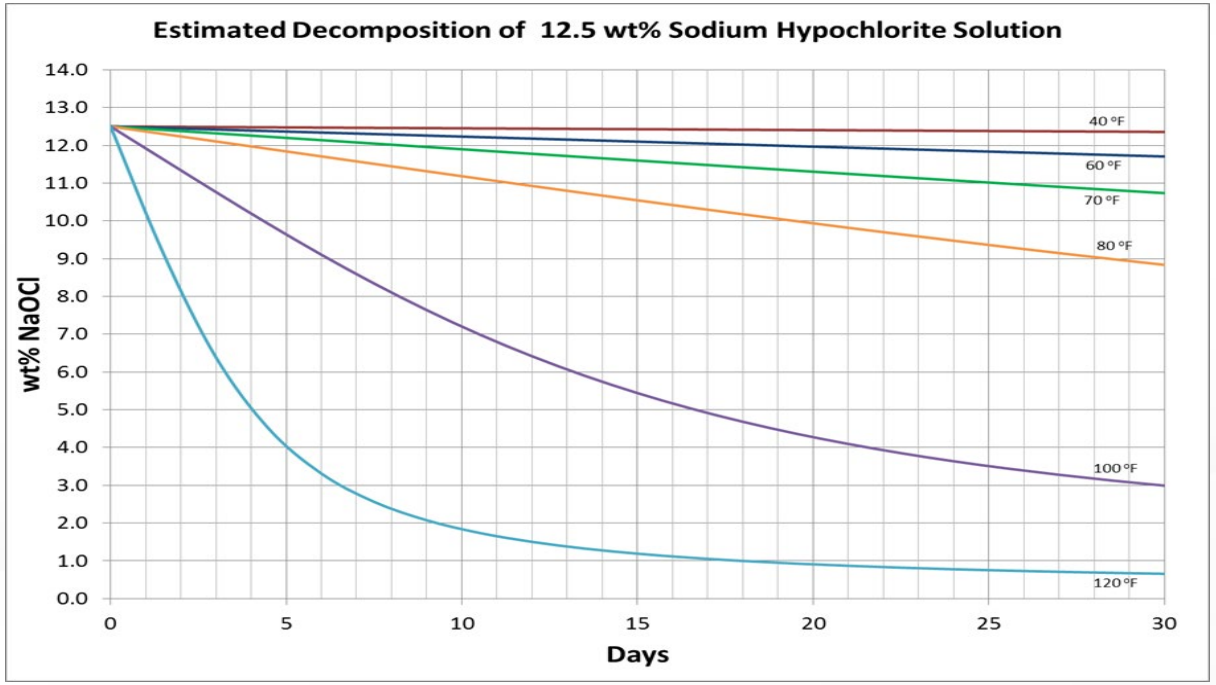
Chemical Properties

Decomposition

- Factors affecting decomposition/stability rates:
  - Temperature
  - Bleach concentration
  - Metals contamination
  - U.V. light exposure
  - Alkalinity/pH
  - Ionic concentration
    - Also called the salt factor.

Chemical Properties

Stability - Temperature Effect



The decomposition rate of NaOCl solutions increases by a factor of 2 to 4 for every 18° F rise in solution temperature.

Chemical Properties

Alkalinity/pH effect:

- Solutions typically require at least 0.1 wt.% alkalinity (pH >11) as free NaOH to be stable.
- Caustic concentrations greater than 0.2 wt.% do not measurably increase the product stability.
- Caustic concentrations of about 5% or greater can decrease the product stability.

Chemical Properties

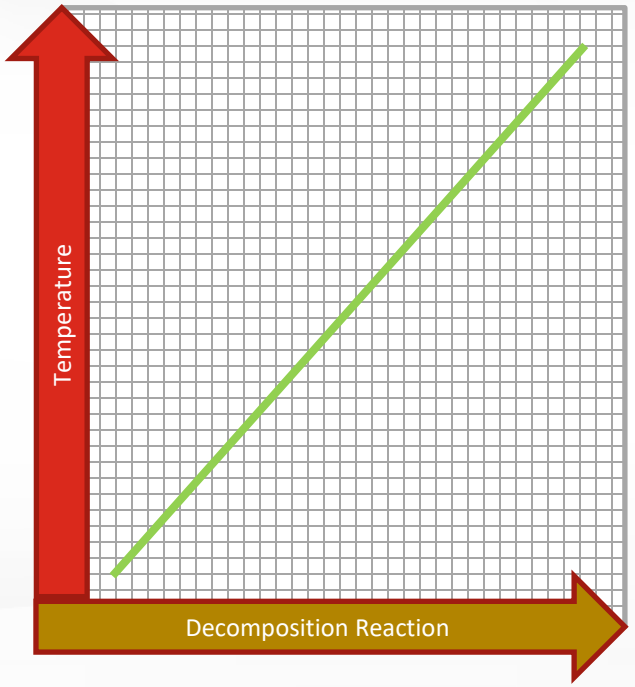
Decomposition chemistry

- In a Basic Solution (pH > 7) – usually “slow” decomposition:
  - Salt and Sodium Chlorate are formed as dissolved salts.
    - $3\ NaOCl \rightarrow 2\ NaCl + NaClO_3$
  - Oxygen is formed as a gas and Salt is formed as a dissolved salt (normally, the minor reaction).
    - $2\ NaOCl \rightarrow O_2 + 2\ NaCl$
  - Certain trace metals greatly accelerate this decomposition.

Chemical Properties

Decomposition chemistry

- All hypochlorite solutions decompose over time:
  - In an acid solution (pH < 7) – much faster decomposition.
    - O_2 and Cl_2 are formed as gases (can be a significant quantity).
    - $NaClO_3$ is formed as a dissolved salt.
  - Higher temperatures increase all decomposition reactions.



Physical Properties Video

Health Hazards

General Information

Health Hazards

- **Sodium Hypochlorite** (NaOCl) is an aggressive corrosive chemical and will attack:
  - Eyes
  - Skin
  - By inhalation
  - By ingestion

Health Hazards

Eye contact

- Sodium Hypochlorite (NaOCl) can irritate and burn the eyes.
- Very corrosive, may cause corneal scarring and clouding.
- Risk of 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 contact

- Sodium Hypochlorite (NaOCl) is corrosive and can severely irritate the skin or cause burning pain, inflammation, and blisters.
- Skin damage may not be immediately apparent and may continue to develop over time.

Health Hazards

Recommended treatment for skin exposure

- Flush with running water for at least 15 minutes.
- Remove contaminated clothing.
- DO NOT attempt to neutralize with chemical agents.
- Seek advice for treatment immediately.

Health Hazards

Inhalation

- Sodium Hypochlorite (NaOCl) can cause severe irritation of the nose, throat, and respiratory tract.
- Can cause headache and dizziness.
- Can irritate the lungs causing coughing, shortness of breath, and pulmonary edema.

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

- Sodium Hypochlorite (NaOCl) is corrosive and can cause chemical burns in the mouth, throat, and digestive tract.
- Risk of perforation of the esophagus and the stomach lining.
- Can cause nausea, vomiting, and diarrhea.
- Coma and death are possible.

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?

Sodium Hypochlorite