GOVERNMENT OF WESTERN AUSTRALIA

FESA
Fire & Emergency Services Authority of Western Australia

HAZMAT Articles

Caustic Soda

Introduction

When caustic soda was first isolated in the late 1700s, it was immediately put to use to manufacture of soap. Soap is made by dissolving animal fat in caustic soda. This process was known as far back as the Romans, however, the only known source that was sufficiently alkaline to dissolve animal fat came from the ash of burnt plants. Even the word alkali, comes from the Arabic “al-qili” which means plant ashes.

Soap was once a rare expensive commodity, and it was only with the advent of caustic soda that it became freely available at affordable prices. Imagine life without soap?

Uses

Today, about 10% of all caustic soda manufactured is used in making soap. It is also used to neutralise acids, in metal cleaning, etching and electroplating, petroleum and vegetable oil refining, as a food additive, and as an ingredient in detergents for laundries and cleaners in kitchens and commercial food processing plants.

In Western Australia, it is used widely in industry for pH adjustment and carbon stripping in extracting gold from ore, in the separation of rare earth metals taken from mineral sands, and in the digestion of bauxite ore to separate alumina ready to be refined into aluminium.

It is also widely available in hardware stores and supermarkets either on its own or as an ingredient in drain cleaners, liquid bleach and other cleaning formulations.

Dangerous Goods

Caustic soda is regulated as Dangerous Goods in Western Australia. It is required to be placarded and labelled as a Class 8 corrosive.

It is transported and stored either as a solid or liquid, usually at 50% strength and a specific gravity of 1.53.

Form	UN	Packing Group	Hazchem Code
Solid	1823	II	2W
Liquid	1824	II	2R

Properties

Chemical name:	Sodium hydroxide
Formula	NaOH
Molecular weight	40
CAS number	1310-73-2
Solubility	108 gms/100ml 20 deg. C
Melting Point	318 deg. C
Boiling Point	1350 deg. C
Specific gravity	2.12 (water = 1.00)
pH (1% solution)	12.7
	Will not burn

Pure caustic soda appears as pearly white pellets or flakes. However it reacts with carbon dioxide to form a microscopic coating of sodium carbonate over the surface, and this changes its appearance to a flat white solid.

$$2NaOH + CO_2\uparrow \rightarrow Na_2CO_3 + H_2O$$

Reactivity hazards

Water: Caustic soda has such an affinity for water, that if a container is left open it will absorb moisture out of the air to become damp quite quickly, even turning liquid given enough time.

It will generate considerable heat on dissolving in water. As it dissolves intense localised hot spots can form in the solution so that a fine mist a caustic soda is thrown off, which is intensely irritating to the nose and throat. In dissolving caustic soda it must always be added slowly to cold water and never the reverse. Otherwise there is the risk of violent spattering.

A worker, in a hurry at a fruit juice extraction plant in Victoria, heated 4,000 litres of water to make the caustic dissolve faster. When he added the caustic soda a hot mixture erupted from the vessel and he was seriously injured.

In Trento, Italy in 1978, enough heat was generated when rain seeped into barrels of caustic soda to cause a series of explosions. A caustic mist spread over the city and thousands complained of skin irritation and nausea. A fire was also started which took 10 hours to control.

Metals: Caustic soda reacts with certain metals such as aluminium, magnesium, zinc, bronze and brass to produce hydrogen gas.

$$6NaOH + 2Al \rightarrow 3H_2\uparrow + 2Na_3AlO_3$$

This is the reason for the following Chemdata message: *Attacks many metals, hydrogen liberated forms explosive mixture with air.*

An aluminium tanker inadvertently picked up a load of caustic washing solution from the Milk Marketing Board, Somerset in the United Kingdom in 1985. When the driver stopped for a rest, he discovered a distorted tank with a vigorous discharge of froth/gas coming through the pressure relief valve.

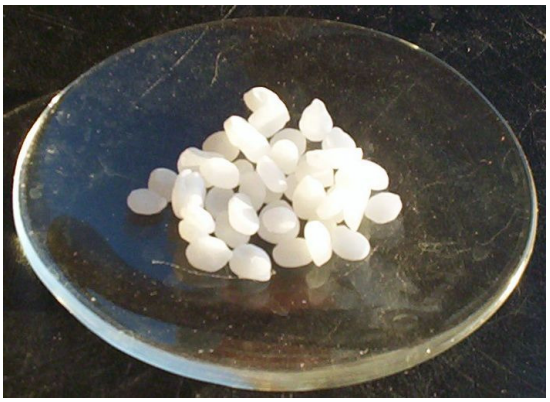
Living tissue: Caustic soda dissolves body fats to form soap. It also dissolves protein to convert it into a soluble gelatinous mass. This is why skin immediately feels slippery after contact with dilute caustic soda. Skin is primarily protein in which there a lipids (fats) produced from glands in the skin to serve as a natural moisturizer.

Health Hazards

Caustic soda is an extremely penetrating substance into any kind of living tissue. It is capable of causing deep ulceration, permanent scarring and blindness. Even solutions down to 0.12% strength can damage the skin within one hour.

If any sort of contact occurs, immediate and continuous irrigation with water is necessary to prevent, if not, limit any damage.

Dilute acids such as sulphuric acid at the same strength are far less aggressive. Acids is contact protein, including skin protein, causes it to coagulate, or solidify, in a way similar to egg white (also protein) when it is fried or boiled. This creates a layer on the outer skin surface which slows any further acid penetration. Not so with caustic soda.



Translucent beads of Caustic Soda

Incident Control

Incidents involving solid or liquid spillage require complete skin and eye protection.

Liquids above 45% strength are also able to react with many materials, and can create slippery conditions.

If any mixed load is involved in an incident in which there is a spill or leak of caustic soda, then advice should be urgently obtained with respect to all items that it may have come into contact with.

The strategies required for incident mitigation will depend on the size of the spillage. Major spills will need to be collected and cleaned up to the specifications of the Department of Environment and Conservation.

Smaller spills could be neutralised with citric acid, while trivial amounts can be washed away with water. It will be quickly neutralised in the environment and will have no further impact.

Spillages which enter water bodies will represent a hazard to all marine life as long as the pH level remains above 9.

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