UOP
A Honeywell Company

# UOP Sulfide Oxidation Process for Treating Spent Caustic

Refining

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### Introduction

The UOP Sulfide Oxidation Process is an efficient and economic catalytic process for the treatment of sulfidic caustic effluents. When hydrogen sulfide ($H_2S$) is scrubbed from hydrocarbon streams, the resulting sulfidic caustic has high biological and chemical oxygen demands (BOD and COD) and a strong objectionable odor. Sulfidic caustic has the least potential for reuse within a refinery. It contains sulfide salts that can lead to fouling or metallurgical damage in refinery equipment, These sulfide salts can potentially release $H_2S$.

The UOP Sulfide Oxidation process catalytically converts sodium sulfide ($Na_2S$) and sodium bisulfide (NaHS) to sodium thiosulfate ($Na_2S_2O_3$), thereby lowering BOD and COD. This is accomplished at mild operating conditions.

### Chemistry

Sulfidic caustic is mainly composed of sodium sulfide and sodium bisulfide depending on the degree that the caustic is spent. The reactions that take place in the UOP Sulfide Oxidation process are shown below:

$$2\ Na_2S + 2\ O_2 + H_2O \rightarrow Na_2S_2O_3 + 2\ NaOH$$

$$2\ NaHS + 2\ O_2 \rightarrow Na_2S_2O_3 + H_2O$$

These reactions are accelerated to an economically acceptable rate at mild conditions by a proprietary UOP oxidation catalyst.

Due to the mild operating conditions, only a small amount of sodium sulfate ($Na_2SO_4$) is formed.

Since free sodium hydroxide (NaOH) is generated in the above reaction, carbon dioxide ($CO_2$) is injected to neutralize this free caustic to lower the pH of the treated product.

### Process flow description

Sufidic caustic is charged from a surge drum to an oxidizer. Steam, air and $CO_2$ are injected into the sulfidic caustic upstream of the oxidizer. The sulfide oxidation reaction takes place over a fixed bed of catalyst in the oxidizer column. The treated effluent from the oxidizer flows through a vent tank where excess air is separated from the aqueous stream.

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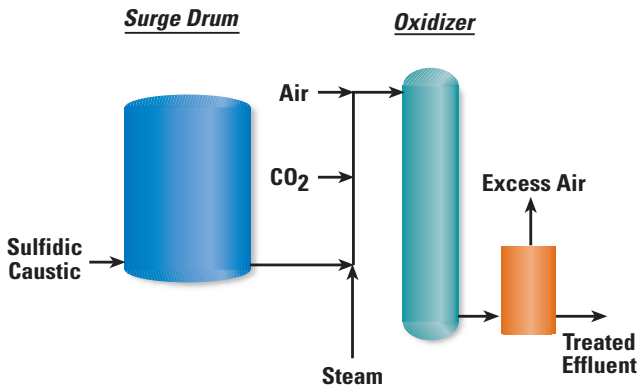


### Benefits

#### Low capital investment

The non-corrosive environment and mild operating conditions allow for carbon steel construction throughout.

#### Low operating cost

Operating costs are low, especially when compared to other spent caustic treating processes.

#### Ease of operation

A UOP Sulfide Oxidation unit requires minimal operator attention. Air and $CO_2$ injection rates are the only adjustments normally required to control operation.

#### Product quality

The treated product usually has reduced pH and BOD / COD and can be directly discharged to existing water treatment facilities.

## Experience

Three UOP Sulfide Oxidation units have been placed on-stream. These units have design capacities ranging from 16.5 gallons per hour (1.5 $m^3$ per day) to 55 gallons per hour (5 $m^3$ per day).

## Catalyst

To ensure that catalyst of the highest quality is available, UOP manufactures a highly active and selective catalyst for the UOP Sulfide Oxidation process.

## For more information

For more information, contact your local UOP representative or our Des Plaines sales office:

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