

to colloidal size and thus facilitate their removal. Caustic soda is used also in washing powders for softening hard waters, because it precipitates calcium and magnesium compounds in the hard waters as carbonates.

The manufacture of glass takes enormous quantities of sodium carbonate. In this industry calcium or lead oxide is fused with a sodium or potassium salt, or a mixture of the two (frequently the carbonate is taken). The resulting product is a double silicate of the potassium or sodium and the calcium or lead. This double silicate is glass.

The manufacture of other chemicals takes a considerable proportion of caustic soda, caustic potash, and soda ash. Quantities of caustic soda are also used in petroleum refining.

The rapid growth in rayon production resulted in bringing the nation's consumption of caustic soda from 35,000 tons in 1924 to 49,500 tons in 1925. Even before the invention of rayon, caustic soda was used in the textile industry for mercerizing cotton. If cotton fibers are soaked in caustic soda solution while the yarn or fabric is kept under tension, the cotton will become more lustrous.

In the reclaiming of rubber, a comparatively new industry, caustic soda plays a very important part. Both caustic soda and soda ash are of importance in converting wood-pulp and other cellulose materials into paper. The recent practice of de-inking book paper requires

160 pounds of soda ash per ton of paper stock. Storage batteries of some types use sodium hydroxide as the electrolyte.

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### The Production of Caustic Soda by Electrolysis

Another branch of the alkali industry consists of electrolyzing salt with the production of chlorine and sodium hydroxide. The first patents covering a process of this sort were taken out by James Watt in 1851. The process was first placed on a commercial scale in 1889 by the German Electron Company, with their plant at Griesheim, near Frankfurt. Other modifications of the process were patented, until today the electrolytic process for making sodium hydroxide is one of the most important chemical industries.

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Although sulfuric acid outdistances all other acids in the annual amount consumed, nevertheless there are many other acids used in large quantities commercially. We should think of this when using the various laboratory acids for which our laboratory procedures call.

The most recent statistics on the amounts of the various acids used each year are those compiled for 1927. The table on page 11 was copied from *Chemical and Metallurgical Engineering*, January, 1929.

## ACIDS USED IN INDUSTRY

### Meaning of the Word Acid

The word *acid* comes from an Old English root word meaning "vinegar." The Old English word, in turn, came from a Greek word meaning "edge." This undoubtedly referred to the sour and edgy taste of vinegar, the first acid of commercial importance.

Vinegar was the most important, and in

fact about the only acid used in industry from ancient times down to the early Middle Ages. It was produced by the fermentation of fruit juices.

In the time of Lavoisier, the great French chemist who first placed the science of chemistry on a quantitative basis, the word acid was applied to the substance which we now call the anhydride of the acid.