▶ Lyes

Lyes are used in many processes as cleaning solutions, scouring solutions, neutralization agents, and as basic materials and additives for the production of important chemicals and other products.

The corrosive and cleaning action of lyes is generally stronger than that of acids. However, when lyes contact most metallic materials, the results are usually the opposite. In other words, they have a much lower corrosion effect on metals than acids. For this reason, it is usually possible to store and pump lyes with economical materials.

The most important lyes are aqueous solutions consisting of ammonia, sodium carbonate, sodium hydroxide, and suspensions of milk of lime and limestone.

These days, alkaline cleaning agents are used in large quantities for cleaning and degreasing metallic components instead of chlorinated hydrocarbons like trichlorethylene, which were more common in the past.
In most cases, the lyes are used in a diluted form that does not place any special requirements on the pump materials.
Unalloyed cast iron is often an adequate material for constructing pumps and fittings used in these applications.

Large quantities of lyes are needed in gas-scrubbing systems, flue-gas cleaners, and flue-gas desulfurization facilities.

Washing solutions of sodium hydroxide are used in small, compact washers.
In cleaning systems that remove solvents from exhaust air, sodium hydroxide is often added to the washing water, which facilitates easier absorbtion and extraction of the solvent.

Since flue-gas cleaning and desulfurization processes require very large quantities of washing lyes, the more economical lyes like milk of lime and limestone are usually used in these situations.
However, this involves suspensions that are not only corrossive, but also contain solids, two things that must be taken into consideration when designing the pump and choosing materials.

One of the major lyes is ammonia, which is commonly used in a 25-percent solution known as ammoniacal water.
Ammonia is the basis for nearly all technically produced nitrogen compounds.
Most ammonia that is produced is used to make artificial fertilizer. Other important products made from ammonia include nitric acid, soda, colorants, chemical fibers, and explosives.

Austenitic stainless steel and cast steel types like 1.4408 are adequate for pumping aqueous ammonia solutions and liquefied, pure ammonia.

Another important lye is sodium hydroxide and its aqueous solution, soda lye.
It is used to produce detergents and soaps, aluminum, water glass, cellulose, colorants, plastics, sodium salts, and other products.

Under normal circumstances, soda lye is only slightly corrossive, but it becomes more aggressive at higher concentrations and higher temperatures.

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In the case of austenitic stainless steel grades, high temperatures increase the amount of symmetrical corrosion and lead especially to tension cracks.
However, using materials that contain a higher amount of nickel can counteract this risk.

Another problem is the strong tendency of concentrated soda lye to creep and crystallize, which endangers the functionality of single action mechanical seals used on Centrifugal Pumps.
For this reason, magnetically-coupled Centrifugal Pumps are recommended in these cases.

When soda lye is produced by the modern membrane cell process, the initial product has a temperature of about 90 °C and a concentration of 33 to 34 percent.
All of the metallic components in this section of the plant (including the Centrifugal Pumps) must be made of nickel or nickel-based alloys. The reason has less to do with the corrosiveness of the lye and more to do with the ion exchange membranes' high sensitivity to free iron ions.

Even during concentration of the initial lye product to the standard commercial concentration of 50 percent, only nickel and nickel-based alloys may be used.
The same applies to the concentration and regeneration of used soda lye.
For these applications, however, the main focus is on the lyes' greatly elevated corrosiveness at higher temperatures.

Bleaching lyes like sodium hypochlorite solutions represent a special case, however.
These materials are so aggressive that only titanium Centrifugal Pumps can do the job.

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