Chemical Reuse, Recycling and Recovery in the textile value chain

Promotion of Sustainability in the Textile and Garment Industry in Asia-FABRIC

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

FABRIC Asia

Evaluation and Economic Assessment of Chemical Streams (Part 01)

14.45– 16:00

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on behalf of GIZ FABRICS and Espire Consult

Agenda

Case Study on Caustic Recovery Plant (Part 01 Benefits of recovery)

Caustic Recovery Plant

Mercerising is responsible for a large amount of strong alkali that is discharged in waste water and needs to be neutralised. The corresponding salt is formed after neutralisation. In this respect, the cold process involves higher emission loads than the hot one. In order to allow the required retention time and make possible the cooling of the bath in continuous mode possible, a portion of the bath needs to be taken out removed and cooled down in continuous mode. This means that higher volumes of bath are necessary in cold mercerising, which also result in higher emissions if the caustic soda is not recovered. Mercerising baths are usually recovered and reused. When this is not possible, they are used as alkali in other preparation treatments.

Description

Caustic soda is recovered from the rinsing water by evaporation and further purified, if needed.

Technical description

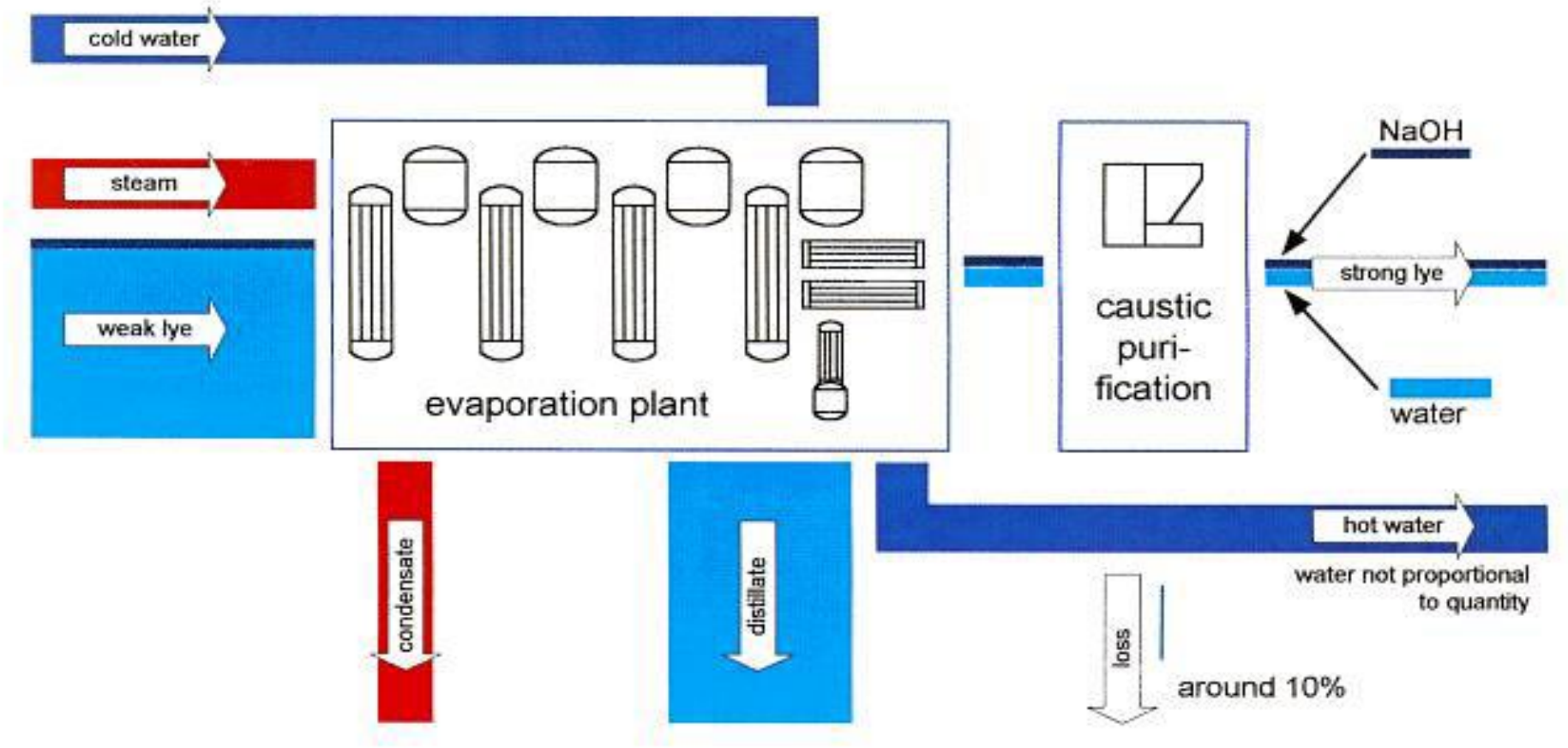
During the mercerisation process, cotton yarn or fabric (mainly woven fabric but also knitted fabric) is treated under tension in a solution of concentrated caustic soda (270-300 g NaOH/l, or also 170-350 g NaOH/kg textile substrate) for about 40-50 seconds. The textile substrate is then rinsed in order to remove caustic soda. This rinsing water is called weak lye (40-50 g NaOH/l) and can be concentrated by evaporation for recycling.

Caustic Recovery

Before evaporation, fibres, and other solid particles are removed by self-cleaning curved screens and microfiltration. In the pre-cleaning stage with curved screens, crystallization of caustic soda occurs via contact of the lye with the carbon dioxide contained in air, resulting in a higher cleaning efficiency compared to rotary filters. More pollution is reduced by the installation of a sedimentation tank.

Weak lye is concentrated in two, three or four steps in the downstream evaporation plant. In the final purification stage, oxidation with hydrogen peroxide destroys the unwanted yellow colour of the strong lye. If the lye is reused after oxidative desizing decolouring can be achieved without any addition of auxiliaries because the bath contains an excess of hydrogen peroxide.
Subsequent cleaning is done by flotation. The recovered lye is cooled before reuse. Subsequently, the cooling water can be used for hot processes. [ÖKOPOL 2011]

Caustic soda recovery process by evaporation followed by lye purification



Caustic soda recovery process by evaporation followed by lye purification

Main achieved environmental benefits

The alkaline load of the wastewater is reduced drastically, and the acid required for wastewater neutralization is minimized. Concentration of the weak lye results in savings of resources (no add-on of new products) and energy (less energy consumption compared to white liquor production).

Environmental performance and operational data

The concentration of weak lye is usually 5-8 °Bè (30-55 g NaOH/l) and is increased may be up to 25-40 °Bè (225-485 g NaOH/l), depending on the mercerizing process applied. When mercerization is carried out on the greige dry textile substrate (raw mercerization), it is possible to the achievable a concentration of caustic soda is not higher than 25-28 °Bè, whereas a concentration of 40 °Bè can be obtained in non-raw mercerization. In raw mercerization, the concentration of impurities is significantly higher, as is the viscosity, which makes it difficult to reach higher concentrations (because the circulation in evaporators is less efficient) [UBA, 2001].

For the evaporation, approximately 0.3 kg steam per kg vaporized water are needed corresponding to 1 kg steam/kg recovered NaOH at 28 °Bé or 1.85 kg steam/kg NaOH at 40 °Bé. [ÖKOPOL 2011]

The higher the number of stages for evaporation, the more often the heat is reused, the lower the steam consumption and, therefore, the running cost. Investment, however, obviously increases with the number of stages.

Recovery of Caustic Soda from Mercerization Process

A detailed description of the Recovery of Caustic Soda from Mercerization Process you find in the separate Annexure as a part of the Informed Choice Matrix under MS Teams access.

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