

Closed system in Caustic Soda Plant with Mercury

Background

Requirement of the Minamata Convention on Mercury

Under the Minamata Convention on Mercury, chlor-alkali plants using mercury-cell are subject to phasing-out by 2025 pursuant to Article 5 and Annex B. If an application for exemption for five years is made pursuant to Article 6, the phasing-out date could be extended up to 2030. It is equally important to operate the existing plants in a safe and environmentally sound manner so that mercury is not released into air, water or land. Since Article 3 of the Minamata Convention prohibits primary mining and restricts the trade of mercury, sustainable management of mercury inside such plants with a closed system would be important from both the environmental and business viewpoints.

The production of caustic soda in Japan shifted entirely to a non-mercury method in 1986. Conversion to the ion exchange membrane process, which was an advanced process at the time, was finally completed in 1999. Japan had the experience of operation and maintenance of a number of plants using the mercury-cell process, when a social need for adequate mercury control arose because of the occurrence of Minamata Disease. Due to this, companies and engineers with know-how of the mercury process still exist in Japan and this flyer introduces the technologies possessed by such companies.



Okayama Chemical Co., Ltd.
Electrolytic bath (October, 1970)

Overview of the Technology

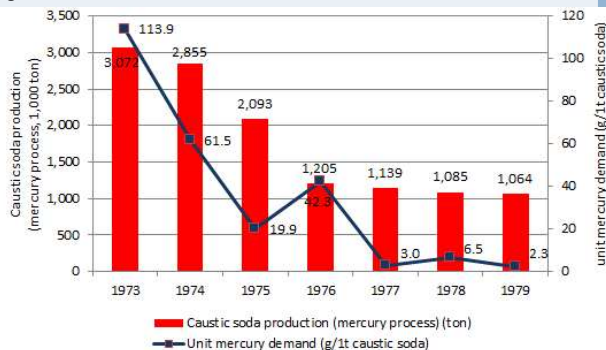
Japanese experience to minimize the loss of mercury from chlor-alkali plants

In response to the public anxiety after the occurrence of the Minamata Disease, the national government decided to encourage the introduction of a closed system at chlor-alkali plants using the mercury-cell process and while also promoting a conversion to its alternative. As a result of efforts by the Japan Soda Industry, the consumption of mercury per ton of caustic soda production fell from 113.9 g in 1973 to 2.3 g in 1979 as shown in the figure below.

Based on this experience, it is possible for Japanese experts to propose measures to prevent mercury leakage from chlor-alkali facilities using the mercury-cell process in other countries.

To implement such measures, the first important step is to identify the actual state of mercury use and then to examine suitable measures based on the situation. A crucial measure, in order to prevent the loss of mercury outside the process, is to establish the material balance, taking into account the following viewpoints;

1. Recovery of mercury in hydrogen gas
2. Prevention of the loss of mercury in brine
3. Recovery of mercury in caustic soda



Trend of caustic soda production by mercury cell and unit mercury demand

Source: Toshiyuki Sugino, "the Pioneer days of electrolytic Chlorine industry in Japan, CHEMICAL INDUSTRY, 1993"

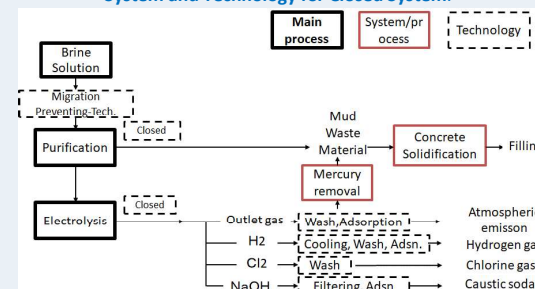
Advantages/Strengths

Technical support for minimizing mercury loss

As chlor-alkali plants with mercury cells use a large quantity of elemental mercury, there is a possibility that the emission and release of mercury can pose a severe risk to the environment and human health. The introduction of a closed system not only prevents the leakage of mercury, but also improves the long-term profitability of plant operation due to a quantitative decrease of the mercury that needs to be purchased. The possible prospect of an increase in the price of mercury, and a reduction of its stable supply with the implementation of the Minamata Convention makes the introduction of such a measure increasingly necessary, if the plants are to be operated until the phase-out date.

Japan possesses the required technologies and know-how to propose, construct, operate and maintain a closed system for the mercury process and to monitor the leakage of mercury. Moreover, Japan also possesses technologies of ion-exchange membrane to replace the mercury-cell and to dispose of waste elemental mercury to be generated after decommissioning of plants in an environmentally sound manner, illustrating Japan's strength regarding its ability to offer a package of technologies to meet the conditions and needs of individual countries.

System and Technology for Closed System.



information provided by Osaka Soda Co., Ltd.

Applicability

Potential to minimize mercury loss in your country

Despite the move to ion exchange process, senior experts with the experience of operation and maintenance of mercury cells still exist in Japan. With support of Ministry of the Environment, Japan, such senior experts were dispatched to countries where mercury cell plants still exist, in order to provide technical and practical advices to plant operators for better mercury control. Strengthening of the analysis and monitoring capabilities is crucially important, because, in order to be able to propose appropriate improvement measures, it is essential to quantitatively understand the actual situation of the usage and leakage of mercury.



Photo taken at Petrochemical Company in Iran

Further Reading

Soda Handbook (1975), Japan Soda Association (Japanese only)

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