

QUALITY ENABLES.

Case study about chlor-alkali brine purification in a chemical plant in south India

QUALITY WORKS.

LANXESS
Energizing Chemistry

Photo courtesy of Indian producer of chlor-alkali products

Efficient Chlor-alkali Membrane Protection – A new generation of Lewatit® resins for ultra-high brine purity

Application and system design

The industrial customer is a leading producer of chlor-alkali products in the Indian market. The existing caustic capacity of the plant amounts to 190 kt/yr resulting in a sodium chloride brine feed of 100 m³/h for this case study review. The brine used in ion exchange membrane electrolysis requires pretreatment to remove high levels of impurities and other contaminants that lead to hardness. In order to protect the highly sensitive electrolysis membranes and substantially optimize the efficiency of the brine purification system, **Lewatit® MDS TP 208** is used for fine polishing. In service are three ion exchange filters installed in a merry-go-round set-up securing a hardness reduction from an incoming level of 2 mg/l to below 10 µg/l (Ca²⁺, Mg²⁺). Barium and strontium levels are additionally monitored and controlled below 100 µg/l.

At a glance

Industry	Chlor-alkali industry
Application	Brine purification
Location	South India
Ion exchange resin type	Lewatit® MDS TP 208 Lewatit® MonoPlus TP 208
Installation	In total: 14 filters, 2x merry-go-round, 4x lead-lag
Case study focus on	3 filters merry-go-round, 2x Lewatit® MonoPlus TP 208, 1x Lewatit® MDS TP 208
Production capacity NaOH	520 tons/day, 190 kt/year
Production capacity NaCl	100 m ³ /h
Brine type	NaCl 305 g/l, high content of Ca ²⁺ , Mg ²⁺

X Lewatit®

Ion exchange resin performance

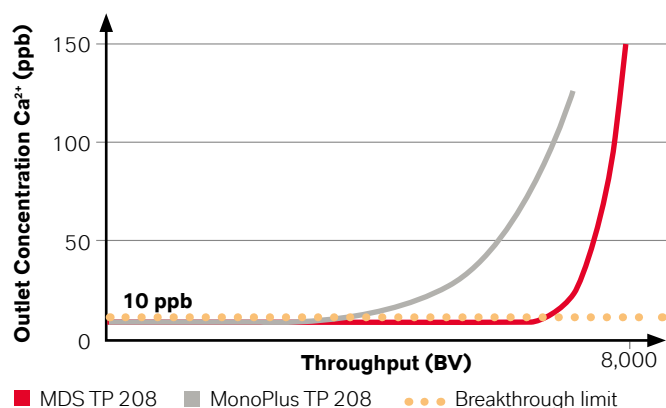
In order to maximize cost savings and gain higher operational simplicity, the brine purification process has been successfully improved. **Lewatit® MDS TP 208** gives access to significantly higher operating capacities, securing high removal rates and extended cycle times (Figure 1: Breakthrough curve of **Lewatit® MDS TP 208** in comparison with **Lewatit® MonoPlus TP 208**). For comparison purposes, one filter was equipped with **Lewatit® MDS TP 208** to compare performance with **Lewatit® MonoPlus TP 208**. On average over the eight months since start-up, the operating capacity at a breakthrough limit of $< 10 \mu\text{g/l}$ of hardness was elevated from 4,480 BV to 6,660 BV of brine throughput, resulting in a 49% of capacity enhancement for **Lewatit® MDS TP 208**.

Optimization of the system to exploit the full resin capacity is possible and is currently being examined.

Figure 1: Average breakthrough curves of **Lewatit® MDS TP 208** and **Lewatit® MonoPlus TP 208** over an 8-month period.

Operating conditions:

Brine flow rate: $100 \text{ m}^3/\text{h}$, $[\text{Ca}^{2+}/\text{Mg}^{2+}]$, feed: 2 mg/l , $[\text{Sr}^{2+}]$: 1 mg/l , $[\text{Ba}^{2+}]$: 0.5 mg/l , $[\text{NaCl}]$: 305 g/l , pH: 10, temp: $60 \text{ }^\circ\text{C}$, SV: 25 BV/h .



Operating conditions found in the eight month average exhaustion cycle:

Lewatit® MonoPlus TP 208:

Operating capacity: 9 g Ca/l
Cycle length: 179 h
Purified brine/cycle: $4,480 \text{ BV}$
Pressure drop across resin bed: 0.4 bar
Filter nozzle slit width: 0.25 mm

Lewatit® MDS TP 208:

Operating capacity: 13.3 g Ca/l
Cycle length: 266 h
Purified brine/cycle: $6,660 \text{ BV}$
Pressure drop: $< 1.0 \text{ bar}$
Filter nozzle slit width: 0.25 mm .

The 2-years average performance of installed resins since start-up in 2016 until September 2018 is resulting in a 53% capacity enhancement by elevation from $3,035 \text{ BV}$ to $4,662 \text{ BV}$ of throughput by **Lewatit® MDS TP 208**.

Conclusion

More efficient brine purification can be secured by the use of **Lewatit® MDS TP 208**. A significant improvement of operating capacity for hardness removal paired with secure limit removal below $10 \mu\text{g/l}$ of hardness and below $100 \mu\text{g/l}$ of strontium and barium allows cost savings due to operational improvements and electrolysis membrane protection, thereby extending the membrane lifetime. The positive results convinced this customer to change the remaining brine polishing resin filters into **Lewatit® MDS TP 208** as well. Application recommendations for **Lewatit® MDS TP 208** and **Lewatit® MDS TP 260** are available upon request.

We are happy to support your business. Please contact us for additional information: visit www.lpt.lanxess.com

LANXESS
Energizing Chemistry

LANXESS Deutschland GmbH
Liquid Purification Technologies
Kennedyplatz 1
50569 Cologne Germany

Phone: +49-221-888-50
E-mail: lewatit@lanxess.com

Health and Safety Information: Appropriate literature has been assembled which provides information concerning the health and safety precautions that must be observed when handling the LANXESS products mentioned in this publication. For materials mentioned which are not LANXESS products, appropriate industrial hygiene and other safety precautions recommended by their manufacturers should be followed. Before working with any of these products, you must read and become familiar with the available information on their hazards, proper use and handling. This cannot be overemphasized. Information is available in several forms, e.g., material safety data sheets, product information and product labels. Consult your LANXESS representative in Germany or contact the Regulatory Affairs and Product Safety Department of LANXESS Deutschland GmbH or – for business in the USA – the LANXESS Corporation Product Safety and Regulatory Affairs Department in Pittsburgh, PA, USA.

Regulatory Compliance Information: Some of the end uses of the products described in this publication must comply with applicable regulations, such as the FDA, BFR, NSF, USDA, and CPSC. If you have any questions on the regulatory status of these products, contact – for business in the USA – the LANXESS Corporation Regulatory Affairs and Product Safety Department in Pittsburgh, PA, USA or for business outside US the Regulatory Affairs and Product Safety Department of LANXESS Deutschland GmbH in Germany. The manner in which you use and the purpose to which you put and utilize our products, technical assistance and information (whether verbal, written or by way of production evaluations), including any suggested formulations and recommendations are beyond our control. Therefore, it is imperative that you test our products, technical assistance and information to determine to your own satisfaction whether they are suitable for your intended uses and applications. This application-specific analysis must at least include testing to determine suitability from a technical as well as health, safety, and environmental standpoint. Such testing has not necessarily been done by us. Unless we otherwise agree in writing, all products are sold strictly pursuant to the terms of our standard conditions of sale. All information and technical assistance is given without warranty or guarantee and is subject to change without notice. It is expressly understood and agreed that you assume and hereby expressly release us from all liability, in tort, contract or otherwise, incurred in connection with the use of our products, technical assistance, and information. Any statement or recommendation not contained herein is unauthorized and shall not bind us. Nothing herein shall be construed as a recommendation to use any product in conflict with patents covering any material or its use. No license is implied or in fact granted under the claims of any patent.

All trademarks are trademarks of the LANXESS Group, unless otherwise specified. Status 12/2018.