



Basic process Intensification (PI) Scan of the Sodium Borohydride Plant of Rohm and Haas at Delfzijl.

Result evaluation and step forward (Phase II)

Management Summary

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Background information

In relation to the M&T and MJA2 programs and in cooperation with SenterNovem a PI scan has been performed by DSM / ACES for the Sodium Borohydride Process of Rohm and Haas Delfzijl to identify possibilities for the reduction of energy consumption through process improvements.

The Scan has been performed in October 2006 and the report evaluated in November 2006 at SenterNovem Utrecht.

PI Scan outcome summary:

The score for overall potency of the PI for the Rohm and Haas SBH process has been judged as **“limited”** for the short term and **“Moderate”** for the long term.

Possibilities for short/medium term PI-improvements, related to energy savings can be sought in the application of high-intensity mixers/reactors and intensive methods for phase dispersion in the hydrogenation step.

On the long term investment in a unit for on-site production or recovery of metallic sodium could be a possible option to reduce energy consumption in the chain.

- Electrolysis of molten or aqueous NaOH (Millenium cell Inc)
- Reduction of molten NaOH with natural gas. (Powerball Ind.Inc)

Follow-up and further Phases

1. Short term and Mid term

A meeting with ACES experts on mixing and reaction engineering will be held in Q1- 2007.

Goal; to determine the possibilities of a series of " proof-of-principle" tests for the improved mixing in the primary and secondary reactors of Rohm and Haas.

2. Long term

Rohm and Haas is investigating via his R&D centre the possibilities for the electrolyses and reduction of molten NaOH to reduce the energy consumption in the chain and related costs.

Close contact with Millenium cell Inc and Powerball industry .inc has been established and will be continued to follow-up on the developments and possibilities for implementation.

General evaluation PI-Scan

The PI-Scan as conducted has been proven to be a valuable tool for a quick evaluation of the possible improvements in our process. At the minimum it confirms past recognised possible improvements and stimulates (or justifies) actions towards these improvements.

Perhaps the most advantages outcome of the PI-Scan is that it provides a high profile technology network for process improvements that would be less accessible otherwise for smaller companies or local subsidiaries of multinationals.