INTER-OFFICE MEMO **TENNECO CHEMICALS, INC.**

TO	D. C. Coldiron	AT	Piscataway	DATE	April 15, 1977
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SUBJECT	B. F. GOODRICH CLEAN REACTOR TECHNOLOGY ESR 1092				

The attached report by Saul Edenbaum summarizes our observations and recommendations to date on the B. F. Goodrich clean reactor technology. We still have one more month of testing work allowed under the agreement with B. F. Goodrich.

Plans for the installation of this system into our Burlington and Flemington plants should be given careful consideration. The economic balance between an expensive automated system and simpler manually operated system should be studied.

We will be in a position to start working with a project engineer to define the scope and cost of implememting this project within two weeks.

J. W. Poarch

JWP/ib
Attachments

COLORITE 018368

B. F. GOODRICH, CLEAN REACTOR TECHNOLOGY

PRELIMINARY REPORT OF

RECOMMENDATIONS AND OBSERVATIONS

Saul Edenbaum
April 15, 1977

Introduction:

During the past eleven weeks, (and continuing into the next month), we have been evaluating the B. F. Goodrich "Clean Reactor Technology" system. This procedure involves spraying all internal surfaces of a reactor with an aqueous solution of a special purple powder manufactured by B. F. Goodrich. When a batch is completed and dumped to the stripper, the reactor is recovered, then rinsed with water to remove residual polymer and fouling, and then coated with the special solution. Excess solution is then removed from the internal surfaces of the reactor by rinising with water. The reactor is then ready for production of the next batch. After repeating this procedure for about five batches, a multimolecular layer of this coating will have built up on all internal surfaces, inhibiting polymer from sticking on these surfaces. This results in extremely clean internal surfaces throughout very lengthy continuous operation of the reactor. Our findings as to the operation of our copolymer and homopolymer reactors on this cleaning technology are summarized herein. These conclusions are based upon the results obtained from production batches during the trial period.

Recommendations

1. Based on a P&ID now in preparation, a conceptual engineering estimate should be made.

2. The technical feasibility of the BFG coating system is sound. A detailed economic analysis must be made to guide our decision to procede with licensing agreements with Goodrich.

3. One of the greatest potential benefits which can be derived from the BFG system is closed reactor technique. The economics of this technique should be included as part of the study in 2 above. The specific equipment and technique needed for adding gelatin and lauroyl peroxide to the closed reactor must be defined.

4. Pilot plant tests should be run using the Shin-Etsu reactors and formulations to determine if the BFG coating offers any advantages over the OC coating used in Pasadena.

Summary of Conclusions:

1. Reaction time at temperature[1] on most types of products can be reduced by 0.5 - 1.0 hours. This is accomplished by

   a) improved heat transfer due to cleaner walls
   b) being able to increase catalyst levels due to this improved heat transfer condition.

2. During the recent EPA qualification testing in the homopolymer plant, the coated reactors (13 & 14), yielded on the average, one-half the residual monomer concentrations, 950 ppm vs. 1750 ppm. This indicates a potential savings via possible reduced reactor recovery time for coated reactors.

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3. The minimum concentration of coating solution proven effective to date is 0.5% of the purple powder. Assuming an internal manufacturing cost[2] of $6./LB for this material, the cost of the coating material per pound of resin is $.00063. This is based upon using the 0.5% solution, at the rate of 25 gallons per application (batch), and 9500 LBS of resin per batch.

   note: in the near future we hope to demonstrate the use of a more dilute/optimized solution per B. F. G.. This solution is 0.05% and will reduce this cost by 10x.

4. "Alternate batch coating" procedure has been shown to be as effective as "every batch coating". This will decrease the coating material cost by a factor of 2.

5. Copolymer reactors proceed to fifty consecutive batches before requiring a gunning out. This amounted to 1½ hours cleanout time, no entry required. This represents three cleaning cycles at a shutdown-hour savings of 6 hours per cleaning or 18 total reactor hours; or a savings of 0.4 hours per batch.

6. Homopolymer reactors proceed to 75 batches (and still going) without any type of shutdown for cleaning. This represents 15 cleaning cycles at a minimum, at a shutdown-hour savings of 5 hours per cleaning or 75 total reactor hours. This represents an average savings of one hour per batch.

7. B. F. G. informed us that their total cost for implementation of the coating system into the Avon Lake Plant (16 reactors, 4000 gal) was about $100,000. This is for a non-recycle/recovery of coating material. A recycle system would nearly double this cost.

1. total time from at temp to dump pressure.
2. B.F.G. quoted a manufacturing cost of $6 per pound, possibly lower. They suggest that we make our own coating material - processing is simple.

8. In the past, specialty resins such as BR-521 caused heat kicks after only two-three batches of production due to heavy buildup. Coated, R-1 and R-2, produced twelve consecutive batches of BR-521 without any signs of a heatkick. Even more savings of cleaning time can be gained here than reported in conclusions 5 and 6.

9. Evaluation of the coating process at Flemington has been successful. Presently they have switched to coating every other batch in attempts to duplicate our success at this. Flemington personnel have observed the same self-cleaning effect after five to eight batches as was seen during the startup of Burlington on the coating.

10. At this time two dispersion towers have been coated and evaluated. Due to the geometry of the tower, it is impossible to rinse the walls clean enough to warrant successive coatings. A cleaning procedure similar to the one presently used is needed, thus apparently little or no time can be saved. At this time we therefore do not look favorably at the use of the BFG coating on dispersion towers.

Discussion:

1. Waste Considerations - the coating material (purple powder) will precipitate out in a slightly acidic medium. Once precipitated, it takes a very high pH to get it back into solution. Goodrich presently dumps their coating solution (.05%) directly to the sewers/drains. Little if any color escapes the plant effluent. BFG reports that they have not been able to detect the coating presence in the effluent in the 10 ppb range.

2. Personnel Exposure/Toxicity - BFG reported that the only hazard established as a result of tests on rats were eye irritations. The material was found to be non-carcinogenic. Details of these tests are in a report that is being sent to us by BFG.

3. Manufacturing of the Coating Material - BFG strongly suggests that we manufacture the coating material. Art Hastings has assured us the process is a simple one, requires small investment, and that the material can be made for $6 per pound or less. The alternative, buying it from BFG, would result in a cost of $25/LB. It is made by R&D and the price reflects high overhead costs. They will give us the technology for making the material as part of the licensing agreement.

4. Optimization of Coating Solution Concentration - Due to the high cost of the coating material, the smallest solution concentration possible should be used. BFG has given us a .05% solution recipe, using ascorbic acid, and PVA (as a wetting agent) in solution with the purple powder. They use this recipe at Avon Lake to great success. Evaluations on both homopolymer and copolymer reactors at Burlington are planned as soon as possible. R&D is presently evaluating effect of PVA concentrations on gelatin stability. Given the O. K. by R&D, we will proceed.

5. Surplus Equipment - We plan to check surplus equipment within Tenneco as a possible money saver when looking for tanks and vessels in the implementation of the coating system.

6. Closed Reactor Technology - Implementation of the BFG system would put us one step away from a closed reactor process. All that would be needed is a way to change the L. P. and gelatin charging into the reactors. Both EPA and OSHA requirements would be easier to meet via this route.