

## **Development of process technology for SMAS and ATBS**

2-Methlyallyl sulfonic acid sodium salt (SMAS) and 2-Acrylamido-2-methyl-1-propane sulfonic acid i.e. ATBS are specialty monomers used in the acrylic fiber industry for imparting dye-affinity to the fiber. Polymers prepared by using ATBS as co-monomer are also extensively used in the enhanced oil recovery (EOR) by crude oil companies. Similarly, ATBS is used in water treatment chemicals and in preparation of specialty polymers. Both these monomers were being imported in India by the acrylic fibre industry and ONGC from global majors like Lubrizol, USA (ATBS) and Degussa and Huls, Germany (SMAS). The domestic demand for ATBS is about 300 tonnes and SMAS, about 400 tonnes per year. The global market size is about 25,000 tonnes for ATBS and 10,000 tonnes for SMAS.

M/s Vinati Organics Limited (VOL), Lote, Maharashtra is in field of fine chemicals and pharma intermediates since 1990s. VOL approached NCL to explore the possibility of setting up a manufacturing facility for ATBS and SMAS. NCL had earlier developed a process for SMAS and ATBS in the bench scale and, therefore, had requisite experience.

NCL performed the techno-economic feasibility study based on which VOL signed a sponsorship agreement with NCL in May 2000 to develop a comprehensive technology for producing these two specialty monomers. Under this agreement NCL had the responsibility to develop and demonstrate the process on bench scale, to validate and demonstrate the process on pilot scale with recovery and recycles, to deliver a basic engineering package (BEP) and to provide assistance for start-up and commissioning of the plant.

A dedicated team of scientists and technologists headed by Dr P.P. Barve developed a novel process for ATBS, which was both efficient and cost effective. NCL also developed a novel and highly improved method of recovery of excess acrylonitrile in ATBS process.

Samples were collected at each technology stage, i.e., bench stage, pilot stage and commercial plant stage and sent to the secondary customers for certification. The product produced in the commercial plant was submitted globally to various customers for their testing and approval. In general, it was found that each customer had his own requirement in terms of the product purity and impurity profile. After getting feedback from the customers about the quality of the product, the technology issues related to market needs were resolved by NCL through additional process development work. In general, novel purification methods were developed and demonstrated on commercial scale for various grades of ATBS and SMAS.

### **Following major activities were carried out during project tenure**

- Process was successfully developed in laboratory for both the monomers.
- Process was successfully demonstrated to VOL on the bench scale for SMAS (200 gm/batch scale) and ATBS (1000 gm/batch scale).
- Process was successfully demonstrated to VOL on the pilot plant scale for SMAS (8.00 kg/batch scale) and ATBS (A continuous process of ATBS at 0.5 kg/h scale).
- During BEP preparation, the special equipments like agitated thin film evaporator (ATFE), agitated nutsche filter (ANF) and rotary vacuum peddle dryer (RVPD) were identified for some steps. Trials for these were conducted at customer's site.
- BEP for 750 TPA SMAS and 1000 TPA ATBS was delivered.
- Comprehensive assistance to the detailed engineering firm was provided during engineering, procurement and construction phases of the project.
- NCL team provided extensive assistance to VOL for start-up, commissioning of the plant and training of personnel.

### **Details of commercial plant**

The SMAS and ATBS plants are two separate dedicated process plants constructed at the customer's site with common utilities separated by a common walkway. Although the raw materials are almost same they employ an entirely different process technology. The combined manufacturing facility is situated at A-20, MIDC, Lote-Parasuram, Chiplun. The factory is spread

over 28000 sq.m area and comprises the process plant, analytical laboratory, raw materials and finished goods storage, utility building and administration building. There are over 125 major pieces of equipment in the process plant. The SMAS plant is based on a batch process, whereas in the ATBS plant the reaction and solvent recovery is in continuous mode, while ATBS purification is in batch mode. The technology development board (TDB), New Delhi provided a financial assistance to VOL for implementing this project.

**Present status**

The installed capacity of the ATBS is 2000 TPA and for SMAS is 1000 TPA. VOL has invested till date approximately Rs. 25 Crores in creating this manufacturing facility. VOL is producing both the monomers as per demand and is supplying and exporting most of its production to various countries. VOL is competing globally on both cost and quality. VOL is third manufacturer in the world to market these products.

The process developed by NCL is protected by two US patents (**6,504,050** and **6,660,882**). A third PCT application has been filed.

The technology on “Development of a complete process technology for manufacture of 2-Acrylamido-2-methyl-1-propane sulfonic acid (ATBS)” was selected for the CSIR Technology Awards-2005 for the Chemical Technology along with IICT, Hyderabad.

The Technology Prize carried a cash award of Rs. 2.00 lakh, a plaque and citation. The award was presented by Shri Somnath Chatterjee, Hon’ble Speaker, Lok Sabha on CSIR Foundation Day Celebrations at New Delhi.

This technology was also awarded with the “Technology of the Year Award” sponsored by ICICI Ltd on the NCL Foundation Day, the 3<sup>rd</sup> January 2005. NCL also honored VOL with a citation for commercializing ATBS technology. Shri Vinod Saraf, Managing Director of the company while accepting the citation thanked NCL management and the team of scientists and technical staff for their continuous co-operation. “From experience, we can say that providing a technology transfer document or a basic engineering package for a commercial plant merely does not end the work of the research institute”, stated Mr Saraf. The demand for ATBS is growing and it has multiple uses in manufacturing acrylic fibre, water treatment chemicals, oil field chemicals, emulsion polymers for paints, coatings, personal cares, adhesives and latex. Mr Saraf informed that Vinati Organics is exporting the product to various countries like Belarus, Bulgaria, China, Iran, Italy, Mexico, Turkey, etc.



Plant commissioned to produce ATBS & SMAS at Lote MIDC, Chiplun (Maharashtra)



Dr. Barve receiving the CSIR Technology Prize at the hands of Shri Somnath Chatterjee, Hon’ble Speaker, Lok Sabha. Also seen are Dr Mashelkar DG CSIR and Shri Kapil Sibal, The Honourable Minister of State (Independent charge) for Science & Technology and Ocean Development