



# MUSINGS OF A CHEMICAL ENGINEER

## RAJAN SHAH'S COLUMN

I have been working in the chemical industry since 1967. My first professional job was in USA as a development engineer in a firm engaged in petrochemical process development and design, engineering and construction of petrochemical plants. In those days graduating engineers had a wider choice of jobs and I chose this job because I wanted to learn how chemical plants are designed and engineered by practising chemical engineers. I was not totally surprised to find that designing and engineering an actual chemical plant was very different from the way senior year design courses were taught. We had outstanding faculty at MIT but their primary focus was research and most of them had never actually designed or operated a working chemical plant. So my first lesson was that university is the place to learn and master chemical engineering fundamentals but the practice of chemical engineering is best learned from experienced engineers working in industry. Of course a strong grasp of fundamentals is essential for a good design engineer. In my experience, this is the stumbling block for practicing chemical engineers when confronted with complex design issues. So to quote Prof. Warren K. Lewis: "the ability to apply theory to practice is what separates the men from the boys."

This lesson was reinforced for me when, while working, I took a

2 semester post-graduate course in process control that was taught by the head of the process control division of Shell Refineries. We would be given assignments involving design of control systems using techniques described in the textbook. When the assignments were discussed in class, the professor would often point out that if the solution we had worked out was actually implemented at plant

level, the resulting performance would actually be different. He would also describe the changes that were needed to obtain the desired performance along with sound technical explanations for the variations.

I returned to India to work in our family business, which was engaged in manufacture of chemicals. The firm employed one chemical engineer, who had no previous industry experience but had a M.Tech. from IIT. The two of us believed that together we could handle all technical issues and did not need to consult anyone else. How wrong we were! I once remarked to my father that the cost of my studies in USA was insignificant compared to the cost incurred in teaching me engineering

practice. So the second lesson was the importance of mentoring fresh young engineers. Mentoring in the chemical industry was not common practice in India at least until the 1990's and I am not aware whether it is being practiced formally now but in my view there would be significant benefits to doing so.

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(unlike most chemical engineers I had taken advance courses in organic chemistry), process design and detailed engineering, production, training of operating personnel and plant maintenance. Our business was a relatively modest sized operation and we were unable to attract the best technical talent available. This turned out to be a blessing, since I was forced to tackle all types of technical problems. I learned how to increase the mean time between failure (MTBF) of equipment by paying close attention to equipment installation and faithfully following the directions provided in the manufacturers' manuals. As an example, I found that by faithfully following the instructions in the manual for air compressors, we obtained consistent performance



of a new compressor for years without any breakdown including things like bearings replacement. I also found that it was possible to virtually eliminate failure in process equipment by careful and detailed selection of proprietary equipment and their components.

I subsequently formed my own firm to provide engineering services to the chemical process industries. I was competing with many larger and well-known as well as smaller established firms. I was able to differentiate my firm by highlighting my two decades of experience of operating and maintaining chemical plants. I successfully conveyed to my potential clients that "I know what you need in terms of services, even if you don't, because I have been in your shoes".

In late 1990's I moved to Australia and started a consulting practice there. Initially with limited work in Australia, I devoted a fair amount of attention to my Indian business but

over time, I found that it was difficult to operate in both places and so I have reduced, but not eliminated, my engagements in India.

While in Australia I got the opportunity to provide consultancy services in Asia and USA and my experiences in these countries have been different compared to in India. In a subsequent column, I plan to highlight some aspects of engineering practices in these countries and describe my experience of providing consulting services there. My experience there has positively impacted my

engineering knowledge and skills even though the chemical industry in Australia is neither particularly advanced nor anywhere as large as in India.

Between 2005 and 2010 I worked as the CEO in charge of scaling up to pilot plant scale a patented process for a biotech molecule, which had never been commercially produced. In another column I will describe the attitude to work of my colleagues in Australia, who were technically qualified. I do believe we can learn a lot from our overseas colleagues. ■

#### ABOUT THE AUTHOR:

**RAJAN SHAH** received his BS in 1966 and MS in 1967 in Chemical Engineering from the Massachusetts Institute of Technology (MIT), USA. He then worked as a development engineer with MIT Prof. Dr. Ralph Landau's company Halcon International Inc. (part of the Halcon/Scientific Design Group) in New York. He returned to India in 1968 and joined Aniline Dyestuffs & Pharmaceuticals Pvt. Ltd. (ADP). The company had been started by his father, late Shri. Shivanand J. Shah, who was a past president of ICMA (now ICC) and past Chairman of CHEMEXCIL. In 1990 Rajan started Chemet Design & Engineering (I) Pvt. Ltd. to provide design, engineering and construction services for the chemical process industries. He moved to Australia in 1998 and has continued to provide design and process consulting services in Australasia, India and USA. Since 2005, Rajan has also been associated with Biospecialties International Pty. Ltd. as CEO, where he was engaged in developing the manufacturing process for a novel peptide for use as an ingredient in health supplements.