INDIAN INSTITUTE OF CHEMICAL ENGINEERS
AMARAVATI REGIONAL CENTRE
(IIChE-ARC)
JKC College Campus, Ring Road, Guntur

Report on Second Prof. M. V. Rao Endowment Lecture

Dear All

We are very happy to note that 2nd Prof. M. Venkateswara Rao Endowment Lecture was successfully organized on 16th April, 2024 by IIChE Amaravati Regional Centre in association with RVR & JC College of Engineering (A) and all student chapters under IIChE ARC. Prof. K. Krishnaiah, former Professor, IITM & Dean Academic Affairs IIT Tirupati delivered the 2nd Endowment lecture on "Chemical Engineering: Opportunities and Challenges in 21st Century".

Due to unavoidable circumstances Sri J. Murali Mohan, Chairman, IIChE Amaravati Regional Centre expressed his inability to preside over the inaugural function (at the time of Endowment Lecture he was in Hyderabad) & requested Dr. C. V. V. Satyanarayana Vice Chairman, IIChE ARC to preside over the inaugural function and conduct the proceedings.

Ms. B. Sucharitha third year and Ms. K. Krishnavani second year students of chemical engineering of RVR & JC College of Engineering (A) invited the guests on to the dais and requested Dr. C.V.V.Satyanarayana, Vice Chairman IIChE ARC to preside over the inaugural function and to conduct the proceedings.

Ms. Vanapalli Rithija first year student of Chemical Engineering from RVR & JC College of Engineering (A) started the event with a prayer followed by lighting the lamp by the dignitaries on the dais.

Presiding over the inaugural function, Dr. C.V.V.Satyanarayana, Vice Chairman IIChE ARC warmly welcomed the IIChE office bearers who joined on-line, viz., Sri Thakar S Indulal, President-IIChE and the Chief Guest, Sri Shashikant Pokale, Vice-president-IIChE and Prof Sunil Baran Kuila, Honorary secretary-IIChE, both the Guests of Honour of the inaugural function, Prof Kolla Srinivas, Principal RVR & JC College of Engineering, Prof. Krishnaiah, the distinguished speaker of the Endowment Lecture, other dignitaries, participants both on-line and off-line from different institutions including RVR &JC College of Engineering, Guntur, Vignan's Foundation for Science, Technology & Research (Deemed to be University), Vadlamudi, Guntur(Dist.), NIT AP, Tadepalligudem, RGUKT-Nuzvid, IIT-Tirupati and other places for Endowment Lecture. He read out the Chairman's message, sent by Sri J. Murali Mohan, Chairman, IIChE-Amaravati Regional Centre as he was unable to attend the meeting.

Dr Satyanarayana addressed the students present in the audience as well as on-line to have confidence in themselves as they are better placed in rapidly changing global scenario, particularly with regard to sustainable development goals and more importantly with reference to sustainable energy and renewable chemicals of the future. In future there will be many changes in the energy mix, even petroleum refineries will be retrofitted and refurbished to meet the renewable chemicals demand. For this, students have to be more focused in their study and keep themselves updated on latest developments in this area. Another important thing is that chemical engineering students should broaden their knowledge on related subjects like chemistry, physics, biological sciences and even materials science. This will help them to be torch bearers and front-runners in the futuristic scenario.

The Chief Guest Sri Thakar Sunil Indulal, President, IIChE inaugurated the event. In his inaugural message, he welcomed all the participants both on-line and off-line for attending 2nd Prof Venkateswara Rao Endowment lecture. He congratulated Prof Rao for instituting this Endowment Lecture and appreciated him for taking so many initiatives with regard to IIChE-Amaravathi Regional Centre. In his message, he said that the products made by chemical engineering processes have been widely used in human life and the challenge is to provide the products at affordable price with their availability. He further said that opportunities exist for chemical engineers in the coming years in the growth areas such as digital transformation through AI, ML etc, sustainable bio processing techniques, hydrogen energy, fuel cells, advanced materials with nanotechnology etc. Collaboration and cross disciplinary approach will be necessary for the future growth of chemical industry.

Sri Shashikant Pokale, Vice President, IIChE graced the occasion as a Guest of Honour. Congratulating Prof. M. Venkateswara Rao for instituting the endowment lecture and appreciating him for his active role both in Amaravati Regional Centre and in National council as a member, he spoke on some of the challenges for chemical engineers such as ensuring environmental sustainability, safety in chemical industries, lower productivity, keeping pace with advances in technology etc. He further said that the adversity creates opportunity to learn and we need to convert the challenges into opportunities. He spoke about changing energy scenario with regard to hydrogen based

economy, fuel cells and batteries. He expressed his keenness in listening to Prof Krishnaiah, the Endowment Lecture speaker on “Chemical Engineering: Opportunities and Challenges in 21st Century.

Prof. Sunil Baran Kuila, Honorary Secretary, IIChE graced the function as Guest of Honour. In his message he mentioned about his personal relation with Prof. M.Venkateswara Rao and the various activities being organized by IIChE for the benefit of the chemical engineering students. He appreciated the activities being organized by Amaravati Regional Centre year round and conveyed his best wishes for the success of the event.

Welcoming the on-line and off-line participants, Dr. Kolla Srinivas, Principal R.V.R. & J.C. College of Engineering appreciated the IIChE Amaravati Regional Centre for organizing an Endowment Lecture in the name of Prof. M.Venkateswara Rao who worked with us for about 26 years as Professor & Head, Department of Chemical Engineering and Dean Examinations. He conveyed his best wishes and support for the success of the event. He also assured that the College will cooperate to organize any academic activity by IIChE ARC or IIChERVRJCCE student Chapter" in future too.

Prof. M .Venkateswara Rao said that the Endowment Lecture instituted by him with the support of ARC members as one of the annual events of IIChE ARC is to motivate chemical & allied engineering student community especially in Amaravati Regional Centre and expose them to the emerging technological developments and practices of Chemical Engineering and Chemical Industry. He briefly narrated about his journey from a rural background to the university level education in a city, the social and technological challenges he faced and how he overcame them. It is with this background, he said, that he intended to institute an annual endowment lecture and the students must be exposed to the advanced technological developments in chemical engineering at regular intervals through this lecture. He also expressed his gratitude to all guests for gracing the occasion and the distinguished speaker Prof. K.Krishnaiah for accepting to deliver the Endowment Lecture.

Before introducing the distinguished speaker Prof. K. Krishnaiah to the audience, Dr. V.Govardhana Rao, former professor IIT Bombay and immediate past Chairman, IIChE ARC highlighted the contribution of chemical and pharmaceutical industries to the national economy and the opportunities that exist to the chemical engineers in the light of some of the incentives provided by the government in the manufacturing sector. He further said that India has emerged as the 3rd largest eco system for innovation and startups and there are ample opportunities for successful startups in various sectors including agriculture. Chemical engineering and chemistry is going to play a

key role in the 21st century in the context of global warming and mitigating its effects. The energy transition from fossil fuels based economy to hydrogen economy would create a lot of opportunities, but also poses challenges that include large scale infrastructure for refilling stations, cost of hydrogen production, storage and transport, various kinds of electrolysers to produce hydrogen, different kind of fuels cells which can be operated in a temperature range between 160 to 1000 ^{o}C. He advised the students that they should have sound knowledge in the relevant subject to face these challenges and this is possible only with hard work, sincerity and commitment during their studies.

Later Dr. Govardhana Rao introduced the distinguished speaker Prof. K. Krishnaiah to the audience saying that Prof. Krishnaiah is a good friend of him since the days of doing Ph. D at IIT Madras during 1975-79 and it is great privilege for him to introduce him to the audience. H said that he is very sincere, industrious and devoted to the work. His illustrious career spanned about 40 years and made significant contribution to the institutes he worked for and to chemical engineering department at IIT Madras in particular as a teacher, researcher, administrator in the capacity Head of the department, Dean, Academic Research, Vice Chairman, and Chairman for GATE, Chairman, Centre for Continuing Education, Advisor/Mentor, Dean Academic Affairs of IIT Tirupati etc. He earned a reputation of one of the best teachers in the Institute and was awarded the inaugural Srimathi Marti Annapurna Gurunath award for Excellence in Teaching in 2012. He published and presented over 110 scientific papers in various journals and guided 17 Ph.D and numerous M.Tech/ M.S students to earn their degrees. He was honoured with “Lifetime Achievement Award” by Vellore Institute of Technology University in 2016 for his contributions to the profession of chemical engineering and was also presented Eminent Engineer Award 2018 on the occasion of 158th birthday celebrations of Bharat Ratna Sir Mokshagundam Visveswaraya. Lastly Dr. Govardhana Rao warmly invited Prof. Krishnaiah to deliver the 2nd Endowment Lecture of Prof. M. Venkateswara Rao saying that we are very much privileged to have him today as the speaker for this lecture.

Delivering the Endowment Lecture Prof. Krishnaiah systematically introduced the evaluation Chemical Engineering from basic sciences during the period 1915 to 1990. His lecture covered the following:

Progression of chemical engineering as a lag phase until 1915, accelerating growth phase from 1915 to 1960s, exponential growth phase from 1960s 1990s and expected to be an exciting phase in 21st century. During lag phase before 1915 an industrial chemist with some expertise in mechanical engineering used to design plants to produce industrial chemicals. The 1st book on chemical engineering titled “A Hand book of Chemical Engineering” was written by George E Davis in 1901 and the concept of unit operation was first presented in that book.

During accelerating growth phase, based on the years of lecture notes, a text book “Principles of Chemical Engineering” was written by Walker et.al. in 1923. Formal education in chemical engineering was begun in MIT by Arthur D. Little in 1915 and the term “Unit Operation” was coined by him. During this time, the core of the chemical engineering is centered around on Unit operations: heat transfer, mass transfer and momentum transfer comprising of only physical operations and on Unit Processes comprising of chemical reactions. However, unification of most of the common steps in unit operations such as distillation, absorption, adsorption etc for the design purpose was more successful than the unification of the chemical reactions under unit processes. As a result, chemical reaction engineering was born in 1950s and the term chemical reaction engineering was coined by J.C. Vlugter during 1st European symposium in 1957. The research work until 1960s was based on empiricism and the correlations for unit operations and unit processes were developed from the experimental data.

With the advent of the book on Transport Phenomena by Bird, Stewart and Lightfoot coinciding the exponential growth phase of chemical engineering put more emphasis on understanding the basic principles of unit operations with advanced scientific basis from the study of physics and mathematics. During the phase from 1960s to 1990s, unit operations, the principles of transport phenomena, chemical reaction engineering taken together had become unique knowledge base for chemical engineering and dissolved the boundaries between the disciplines. Further the classical name of Chemical Engineering has been extended to Process Engineering to describe all processes involving the treatment of physical, chemical or biological materials. This created a lot of opportunities to chemical engineers in other disciplines too.

In 21st century one of the focuses for chemical engineer could be understanding and developing unification principles in Molecular engineering. Molecular engineers work at the atomic and molecular levels to construct new materials, develop innovative technologies, and design novel molecules and compounds for various applications. The future challenges of Chemical Engineering will be manipulation of molecules to design catalysts, materials, drugs, nano-devices, specific chemicals with minimum steps, biomolecules such as DNA, proteins, enzymes etc., and design of production units. He gave good examples of zeolite catalyst and human and non-human mammals how a small change in the structure makes a big difference. He also listed out various grand challenges in the 21st century such as converting solar energy economically, providing energy from fusion, developing carbon sequestration methods, managing the nitrogen cycle, providing access to clean water, restoring and improving urban infrastructure, advance health informatics, engineering better medicines, reverse-engineering the brain, preventing nuclear terror, secure cyberspace, enhance virtual reality, advance personalized learning, engineer the tools of scientific discovery etc. At the end he presented Bloom’s Taxonomy and cognitive domain that leads to thinking and problem-solving skills.

Overall the lecture was very informative, inspiring and stimulating experience to the students as they may not have known how the chemical engineering has evolved as a separate discipline over the years and the opportunities that exist for them in 21st century.

At the end, Dr.Anil Kumar Banavath, Asst. Professor, Department of Chemical Engineering, NIT AP Tedepalligudem & Executive Committee member of IIChE ARC proposed the vote of thanks.

Total number of participants = 450 (350 students & faculty and 100 working professionals). The huge response of the participants across many regions of the country is the testimony how curious and enthusiastic the participants are to listen to the Endowment Lecture.

As per the feedback from the participants, Prof. K.Krishnaiah delivered a highly informative, inspiring and thought provoking lecture on "Chemical Engineering: Opportunities and Challenges in 21st Century".. The participants suggested the organizers to conduct many more events in future.

(Dr. M.Venkateswara Rao)
Former Professor in Chemical Engineering &
Dean, Examinations
RVR&JC College of Engineering (A)
Honorary Regional Secretary, IIChE Amaravati Regional Center