Outstanding Scientist

Professor G. D. Yadav Outstanding academician and chemical engineering scientist

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His contribution to chemical sciences and the chemical engineering profession is immense. As Vice Chancellor of the Institute of Chemical Technology, he has taken this world-renowned institution to even greater heights in the five years of his tenure. Read on to discover how a poor but bright boy from a tiny village in Maharashtra who used to walk 5 km barefoot to school and back grew up to lead one of India's premier universities.

A visitor to the beautiful campus of the Institute of Chemical Technology (ICT) in Mumbai would inevitably come across a number of attractive posters with inspiring slogans, many of them written by the Vice Chancellor Professor Ganapati D. Yadav himself. One of them, titled "Reach the Stars" reads:

The Rich. The Poor. The Marginal. The Privileged. The Underprivileged. They studied here. They made it BIG.

Do not ask how to do it. Do it. Underestimate NOT who you could be.

Think Big. Dream Big. Do not dismiss your dreams.

To be without dreams is to be without hope; to be without hope is to be without purpose.

The message comes across as Prof. Yadav's own mantra for success, as an attempt to urge to the students, faculty, and visitors to ICT to become achievers, overcoming every obstacle in their path, like he did. Sheer grit, innate intelligence, hard work, and unwavering faith in himself had enabled Yadav to produce internationally acclaimed research work, rise to a position of eminence as one of the finest engineering scientists in the country, and serve ICT, the Indian chemical industry, and the government of India with distinction.

In December, 2014, the American Chemical Society (ACS), the largest professional society in the world, published a Festschrift (a compilation of the writings of different authors as a tribute to someone) of their reputed journal *Industrial and Engineering Chemistry Research* in recognition of Prof. Yadav's enormous contributions to international chemical engineering. This special issue carried 65 research papers by international scientists. The ACS has also elected him as the only non-American editorial board member of its new journal, ACS Sustainable Chemistry and Engineering, and as the Chair of the ACS India International Chemical Sciences Chapter. Around that same time, the Indian Council of Chemists conferred upon Prof. Yadav its Life Time Achievement Award and Gold Medal. In 2013, The Indian Institute of Chemical Engineers (IIChE) honoured him with the Dr. Burjor P. Godrej Life Time Achievement Award.



Professor G D. Yadav

Childhood and education

Prof. G. D. Yadav was born on September 14, 1952, into a humble peasant family in Arjunwada, a small village in the Kolhapur district of Maharashtra. Till the seventh standard he studied in a school that at first had no building of its own but conducted its classes in village temples, with devotees walking through the squatting groups of students now and then! After this, he was admitted into a secondary school located around 5 kms from his home in a neighbouring village. Every day, he had to walk barefoot to school and back.

When he was in the ninth standard and barely 14 years old, on the advice of one of his teachers, he was enrolled into a school in Kolhapur City that had better facilities and a higher standard of education. However, since his family was too poor to pay the hostel charges, he stayed in the home of a local family as a paying guest. Each morning he woke up at 4 o'clock so he could make time to prepare his own meals, help in household chores, and study. The rigorous daily schedule he set for himself as a child set the foundation for the long hours he devotes daily to his work and other responsibilities till today.

Ganapati Yadav passed his final exams in school with

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flying colours, and won a number of scholarships including a merit scholarship from the Government of India for pursuing higher studies. After completing his school education in the Marathi medium, he had to switch to the English medium for his college studies.

In those days, thanks to the increasing importance of the petrochemical and chemical industries, chemical engineering was one of the most sought after disciplines in India. So in 1970, on scoring excellent marks in his Inter Science exam, that was what attracted young Yadav as well. But, he chose the 4-year Bachelor of Engineering program at the University Department of Chemical Technology (as ICT was called then) in Mumbai over the IIT's 5-year B.Tech. degree program, only because he felt the former slightly shorter program would be more affordable for his parents.

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The UDCT / ICT years

While studying at the UDCT for his Bachelor of Chemical Engineering degree, a lecture by the Head of the Chemical Engineering Department made a deep impression on him. The young professor emphasized the significance of Chemical Engineering and that as compared to the almost ₹ 4000 p.a. the University was spending on each student, the fees the students paid were just

around ₹ 250! That dynamic, young professor was the legendary M.M. Sharma. Perhaps it was then that Prof. Yadav realised the importance of raising funds for the institution so it could continue its work of imparting quality education and training.

Yadav went on to complete his Ph. D. with Prof. M.M. Sharma as his guide. Sharma advised him to focus on the emerging field of phase transfer catalysis (PTC) for his doctoral research. Even after getting his doctorate, Yadav continued to carry out research on PTC and is today one of the most prolific authors and researchers on a range of multiphasic PTC reactions and mathematical models.

G. D. Yadav first joined the UDCT faculty as an Associate Lecturer in Chemical Engineering and served in this position from 1976 to 1980. A short stint at the University of Waterloo followed during which he worked on new methods of enhanced oil recovery, multiphase flow in porous media, flow visualization, network modeling, percolation processes, and modelling the flash pyrolysis of biomass to produce bio-oils.

Prof M.M. Sharma having advised him to return to India as soon as a faculty position became available at the UDCT, Prof. Yadav came back to his alma mater in 1986 to serve as a Reader. Soon afterwards, Sharma offered him the opportunity to work full time for two months at Polyolefins Industries, Ltd. (PIL) as a summer industrial consultant. But the company asked him to continue working for them as a consultant for rubber chemicals on a retainer basis for the next seven years. Since then, Prof. Yadav has been actively offering industrial consultation services to several industries in Mumbai, Delhi, Vapi, Ankleshwar, and Hyderabad, and his suggestions have been successfully commercialised.

Pioneering research

All of Prof. Yadav's research work since 1986 has been accomplished in India. His excellent track record in research and innovation got his research group many research grants. His work on novel methods of enhanced oil recovery with funding from the Oil and Natural Gas Corporation (ONGC) has been patented. He published pioneering theoretical and experimental proof of the well-known phenomenon of inversion in rates and selectivity in Friedel–Crafts reactions. In addition to his introduction of new concepts in PTC, his original research on tri-liquid PTC, the role of the omega phase, and cascadeengineered PTC has been widely acclaimed.

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engineering, energy engineering, biotechnology, phase transfer catalysis, nanomaterials, nanocatalysis, and biocatalysis. His laboratory has synthesised a number of novel mesoporous solid superacids called UDCaTs, MUICaTs, and ICaTs, resulting in 47 patents. So also, his work has offered breakthroughs in the design, synthesis, and industrial applications of novel catalytic materials.

The first to advocate green chemistry and engineering in India, he has developed a number of internationally patented pollution-free technologies, many of which have been put to use in industry. He applied the fundamentals of disciplines ranging from chemical engineering and chemistry, to catalysis, materials, energy, and biotechnology for introducing clean and green processes. Prof. Yadav's remarkable research productivity has earned him interna-

tional recognitions, awards, and prestigious fellowships galore including the Fellowship of the Indian National Science Academy (INSA), the prestigious Jagdish Chandra Bose National Fellowship, and a host of others.

In 2008, Prof. Yadav was declared to be the topmost scientist in India in the field of catalysis based on the Science Citation Index (SCI) database and peer-reviewed papers. That same year, following a survey conducted by the Council of Scientific Industrial Research (CSIR) and also by the Department of Science and Technology (DST) for their PURSE program, he was the only engineer to find a place among the top 20 highly productive and cited scientists in India with diverse research contributions.

Prof. G. D. Yadav's research is characterized by its sharp focus on industrial adoption and commercialisation. Right from his days as a doctoral student till today, a lot of his research has been commercialised. The industrial application of his research work on green technologies and waste minimization has benefited a wide spectrum of industries including energy and pharmaceuticals. In the last five years, he focused on the separation of chiral pharmaceutical compounds using enzymes in nonaqueous media and microwave irradiation. In the area of energy engineering he has developed a novel hydrogen production technology that has resulted in three patents. Currently, pilot-scale experiments for the same are being carried out supported by ONGC.

Yadav also continues to interact and collaborate with international researchers based in the US, Canada, Germany, Finland, Spain, Italy, UK, Australia, Israel, and Japan for different areas of research. He has published over 300 original research papers in 67 high-impact-factor international journals; of these journals, and has two books to his name, and holds 69 international patents. His



Prof G.D. Yadav, VC, ICT Mumbai receiving the Life time Achievement Award and Gold medal at the 13th Annual Conference of Indian Council of Chemists (ICC), Dhanbad.

research on sulfated zirconia, heteropoly acids, clays, and ion-exchange resins has received wide recognition and been cited in over 6500 internationally reputed papers.

To date, he has guided and mentored 76 Ph.D. (Chemical Engineering/Technology, Biotechnology & Chemistry) and 80 Master's thesis candidates, as a single guide. At present 39 graduate students, project scientists, and post docs are carrying out their work under his supervision.

Driving the growth of ICT and other organisations

In 2009, Prof. G. D. Yadav was appointed as the Vice Chancellor and R. T. Mody Distinguished Professor of ICT. Since then, he has successfully mobilized generous donations for renovating and modernizing the Institute, and created endowments for faculty positions and fellow-ships, and scholarships for needy students. He obtained support from the UGC for all the departments, and many of these have received funding of around ₹ 5 to 8 million for infrastructure.

ICT has seen tremendous growth under the leadership of Prof. Yadav. The institute was already rated as the best in chemical sciences and engineering in India, ranked among the top five of its kind in the world, and rated as No. 4 in the world in the volume of research publications, and had been conferred with several prestigious awards. But as the Vice Chancellor, Prof. Yadav took ICT to even greater heights. His most significant contribution has been getting ICT the status of Elite Institute and Centre of Excellence, similar to that of the IITs, IISc, and IISERs, thus making it eligible for special grants from the central and state governments.

Prof. Yadav has proved to be an inspiring leader and role model for students and faculty. In 2012, and 2013,

ICT won the Tata Chemicals AICTE-CII Best Industry Linked Institute Award in Chemical Engineering. Acknowledged as a model for industry-institute collaboration, several prestigious international universities and leading industries from across the world and India have signed MoUs with the ICT for promoting technological research and development. During the last two years, the Bill and Melinda Gates Foundation has awarded four projects of US \$ 100K to ICT. Currently, the DBT-ICT Centre for Energy Sciences, headed by Professor Arvind Lali, is attracting acclaim for the development of industrially relevant technologies. With the support of a celebrated alumnus of ICT, Mukesh Ambani, Prof. Yadav recently set up a unique museum in the Institute called the Dhirubhai Ambani Hall of Fame which showcases the achievements of the chemical sciences and industry in India and the world.

Not just ICT, Prof. Yadav's leadership has also benefited the Catalysis Society of India, Maharashtra Academy of Sciences and the Centres for Nanosciences and Nanotechnology, and Green Technology of the University of Mumbai. During his tenure as the President of the Indian Institute of Chemical Engineers (IIChE), he revitalised the Institute and created a world record by establishing endowments for 51 national awards/prizes. As the Vice Chancellor, Prof. Yadav took ICT to even greater heights. His most significant contribution has been getting ICT the status of Elite Institute and Centre of Excellence, similar to that of the IITs, IISc, and IISERs, thus making it eligible for special grants from the central and state governments.

For his phenomenal contributions to the field of chemical engineering, the chemical industry, and his alma mater ICT, **Chemical Industry Digest** salutes this great Indian engineer-scientist. On completing five years as the Vice Chancellor of ICT, we wish Prof. Ganapati D. Yadav even more success in the years ahead and hope his dream of getting an additional satellite campus for the Institute soon becomes a beautiful reality.

Reference

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