

# Industrial Biotechnology

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# IB Interviews

## A Conversation with Dr. Pramod Chaudhari

*Dr. Pramod Chaudhari, Founder and Executive Chairman, Praj Industries, Pune, Maharashtra, India*

**P**ramod Chaudhari founded Praj Industries nearly 40 years ago because of his affinity for agriculture and a belief that a thriving bioeconomy would benefit both India and the world and be a significant contributor to mitigating the catastrophic effects of climate change. Today, Praj is a leading innovator with a thriving ethanol business, global licensing deals, and deep pipeline of biogas, biomaterials, and biohydrogen technologies. Washington DC-based Biotechnology Innovation Organization recently recognized Dr. Chaudhari's vision, entrepreneurship, and significant contributions to the field of biotechnology by awarding him the 2020 George Washington Carver award.

*Industrial Biotechnology* recently had the opportunity to sit down with Dr. Chaudhari, widely acclaimed as Ethanol Man in industry networks, to discuss his journey, passion for biotechnology, and outlook for a sustainable world.

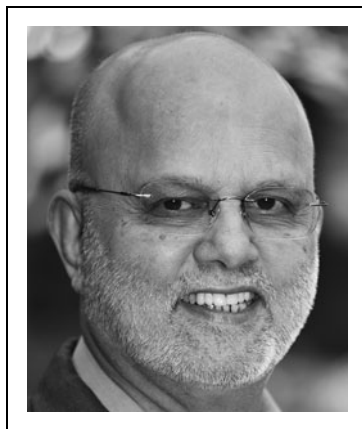
**INDUSTRIAL BIOTECHNOLOGY:** *Can you discuss your background and what led you to found Praj in 1983?*

**PRAMOD CHAUDHARI:** I am a mechanical engineer, having studied at Indian Institute of Technology Bombay (IIT Bombay). I spent some time in my childhood in the vicinity of sugar industry and developed an affinity toward farming community. The sugar industry is very attractive from the point of view of value creation. There are many opportunities to create value-added products from sugar industry including waste streams, the most interesting being molasses.

I gained rich multifunctional experience across the value chain in my decade long tenure in MNCs. That gave me confidence to venture into business and I felt I could make the most impact for India's agriculture sector. That's why I founded Praj with the objective of creating a business in ethanol.

**IB:** *In terms of meeting the sustainable development challenges facing humanity, can you discuss what impact you hope your work will have?*

**PRAMOD CHAUDHARI:** Because of my rural upbringing and exposure to research, I have always endeavored to strike a



**Dr. Pramod Chaudhari**

fine balance between 3P's: profit, planet, and people. Irrespective of business verticals I placed 3Ps at the very core. Together, the 3P's are a formula for sustainability.

In the late 1990s/early 2000s, sustainable development started getting significant importance in all aspects of business and life. Awareness about conserving environment while pursuing growth started to increase. All of this positively impacted my thinking. As an engineer I could easily see multiple benefits of ethanol blending for the country. It provides better air quality, complete combustion, and lower particulate matter. Moreover, it supports the farming community at large by providing higher income. Leftover wastewater or sludge can also be used as organic fertilizer. Biofuels are also circular.

Carbon dioxide is absorbed by plants while goods made from plants, when consumed, emit carbon dioxide. Ethanol also makes economic sense because India imports more than 80% of its crude oil. It is definitely improving India's economy by helping reduce dependence on foreign fuel sources. All elements are addressed by ethanol: environment, economy, energy, society and the farming community.

**IB:** *What are Praj's research and commercial priorities in the near-term?*

**CHAUDHARI:** The approach we took in the early days of Praj, in the mid-1980s, was that innovation would be our cornerstone. We upgraded our R&D facilities twice, first in the early 2000s and then again in 2008. The first upgrade was to develop applications for various coproducts of ethanol production. We developed a process to convert wastewater to biogas and fertilizer. Then we began testing various types of yeast to achieve higher efficiencies in our fermentation processes. We also began characterizing feedstock; molasses in different regions has different properties. We characterized 7,000 samples from around the globe and as a result our process designs are more efficient and economical. This has helped our business globally; today we have over 750 references in more than 75 countries across five continents.

In 2008, we opened a new R&D center and began to develop advanced biofuels from cellulosic biomass. We had a technology developed by 2015 and set up a demonstration plant, processing 12 tons of dry biomass per day. To date, we have signed three contracts for commercial-scale advanced biofuels refineries based on enfinity™—our proprietary 2G technology.

This is a major milestone in the journey of Praj. The first plant is expected to come online early next year and will demonstrate to the world that 2G ethanol technology developed in India is best-in-class.

Our Bio-Mobility™ platform among other biofuels includes ethanol, both 1G & 2G, and more recently we built a demonstration plant for Renewable Natural Gas known as Compressed Bio Gas (CBG) in India. We are also working on future fuels, like sustainable aviation fuel for which we have a partnership with Gevo Inc, USA. We also have plans to move forward in marine biofuels and bio hydrogen. We feel bio-based hydrogen is going to take center stage in the not so distant future. So we have a suite of new biofuel technologies to be commercialized.

We also have major thrust on development of renewable chemicals and materials (RCM) in our R&D facility. Last year we launched Bio-Prism™ portfolio of technologies for production of RCM using bio based feedstock.

Our approach has always been focused across the value chain; i.e. from R&D all the way until design & deployment (D&D). We do the laboratory-level development, process development and then advance to D&D. Demonstration stage is a very important step following research, prototyping and proof of concept. We recently had an opportunity to interact with Dr. Andrew Light, (Acting Assistant Secretary at the U.S. DoE). He was discussing India-US strategic cooperation. He was happy to know that at the ground level, India and US cooperation is advancing. Some of the technologies developed in the US can be advanced to deployment and demonstration-scale, and some of the technologies that we have developed are going to the US for commercialization. Many of requests from the US involve from demonstration plants to scaling up.

One of our projects involves 2G ethanol production in the state of Louisiana. They have a sugar industry and we are trying to develop a project for utilizing bagasse. Bagasse-based biofuels projects are not very common in the US. Currently the bagasse is just being burnt. It's a very promising raw material that we would like to advance for processing into ethanol.

**IB: Can you discuss the Praj Centers of Excellence and why you think a multidisciplinary approach is necessary in the bioproducts industry?**

**CHAUDHARI:** Our Centers of Excellence are vital to our innovation journey. There are numerous departments that are important to the development cycle. It starts with microbiology and molecular biology because the mother of fermentation is microorganisms. We also have expertise in chemical sciences, as well as process engineering and analytical labs.

In the last 5 or 6 years, we have added capabilities in carbon-intensity monitoring. Lifecycle analysis is very important. We can develop a great product, but if it emits large amounts of carbon it won't help anyone. Consumers and industry have become very conscious about carbon intensity.

Cost is another focus of our Centers of Excellence. Both carbon and cost are going to be important if you want to successfully develop and deploy a process.

**IB: How could policy help grow India's bioeconomy sector?**

**CHAUDHARI:** Public policy and awareness are critical to developing and growing a bioeconomy. It helps any country facilitate innovation and implementation. In India as well, I am convinced that the race to zero campaign will get increasingly rigorous, particularly by the time COP26 takes place in Glasgow late this year. The Biden administration signing of Paris Agreement has come as a shot in the arm for the renewable energy worldwide.

I believe policy should encourage and enable innovation. India's government operates a number of laboratories that help do early-stage research work, but the road to commercialization is not easy. We were given an assignment to screen 20,000 soil samples collected from various parts of the country to identify useful microorganisms. We were able to do this with high-throughput screening. It was a classic case of industry, academia and government working together.

Blending mandates are also important. In India, biofuels blending in gasoline started at 5%, then went to 10%. Government recently moved up the 20% blending mandate from 2030 to 2025 and launched a policy encouraging grain-based ethanol production. All of this will help industry move forward. Similar progress is happening in biogas, where we are seeing policies to boost CBG production in India. Projects are underway at multiple locations. We are building a CBG unit for state-owned oil marketing company in the northern part of India. It is definitely an exciting time for the biofuels industry in India right now.

**IB: How do you cultivate and maintain a culture of innovation at Praj?**

**CHAUDHARI:** Innovation is in our DNA. As an entrepreneur, I adopted that philosophy and that is reflected in the culture at Praj. We have structured programs, innovation awards and competitions. Praj Matrix, our flagship R&D center is a classic example of innovation. We encourage failure. It's no problem as long as we learn from it and keep improving!

We also encourage creative problem solving. One example is our skid-mounted equipment. We design the skid in such a way that we assemble & test it here, and then ship it as unit. We then go to the project site and help get it running. It is plug & play in nature and saves installation time, thereby reducing project cycle. Designing a system like this requires creativity and visualization.

We also hold problem-solving competitions at renowned colleges, where we try to identify talent and encourage students to consider careers in industrial biotechnology and green chemistry. I believe this is similar to programs digital technology companies have run in the US.

**IB: You passionately speak about the power of partnerships. Can you throw light on the work you are doing in this area?**

**CHAUDHARI:** I firmly believe that the next spurt of growth for biofuels industry will come through strong collaboration and deriving synergies among industry players. We at Praj have forged strategic alliances with renowned organizations,

institutions around the world so as to leverage complementary strengths. We have many important partnerships.

In association with Sekab E-Technology AB, Sweden, Praj at its R&D center Matrix, has developed optimized technology-Celluniti™ for converting forest residue to ethanol, that offers enhanced project viability and reliability.

In partnership with GEVO Inc, USA, Praj has developed a process for production of Isobutanol - a basic building block for SAF- from sugary streams and agricultural residue. The technology is now ready for commercialization. In a noteworthy development, SAF samples have received certification as fit for use in aircrafts from Indian Air Force.

To proliferate the usage of biofuels in transportation sector, Praj is working with Automotive Research Association of India (ARAI), India's premier automobile laboratory, to drive application developments of advanced biofuels. Ethanol blending with diesel is one of the important projects we are pursuing.

We have also joined hands with National Chemical Laboratory (NCL), India's flagship R&D institution in the sector, for developing promising innovative technology solutions in the RCM space.

**IB: What are you most proud of in your career?**

**CHAUDHARI:** Dr. Carver said, "When you can do the common things in an uncommon way, you will command the attention of the world." I think that says a lot. I am very proud to bring this award to India for the first ever time. We are a developing country, and it is a matter of pride not only for me but for team Praj that our work was recognized by industry in the developed economies.

**IB: What advice would you give a young researcher just starting out in biotechnology?**

**CHAUDHARI:** There are five or six arms of biotechnology. I chose to work in an area of industrial biotechnology that is complex and less common as it involves multi-disciplinary integrated approach. I personally believe that the industrial arm of biotechnology offers tremendous potential to improve the lives of billions of people in years to come. Mass production of bio-industrial products is a bridge between agriculture and industry. Bio based products are carbon-friendly, renewable in nature and they provide solutions for the environmental challenges of today and tomorrow. I think Bioeconomy will play a vital role and deliver solutions at large scale to mitigate risk associated with climate change.

Biofuel is just one part of industrial biotechnology. My mind is always racing thinking about unlimited possibilities this sector can help achieve. We have only scratched the surface and there is a lot more potential to be explored.

There is also a convergence happening with artificial intelligence (AI), machine learning (ML), and biotechnology. My opinion is that, going forward, the bioeconomy and industry 5.0 will converge. I am particularly an admirer of the work being done by synthetic biotech companies. They are bringing to reality the concept of biofoundry by blending AI, ML and biotechnology, thus helping grow bioeconomy. I think that is the future of new research and I strongly suggest young researchers consider these possibilities while choosing a career path.