

Dr. K.H. Gharda Industrial Innovation Award in Polymer Science 2022

Journey of Lab-to- Market Translation of a Silk Fibroin Bone Void Filler

by

Dr. Anuya Nisal

Serigen-Mediproducs Pvt. Ltd.

Date: December 10, 2023

Time: 12:45 pm to 1:15 pm

Venue: MACRO-2023 at Bhupen Hazarika Auditorium
IIT Guwahati

Organized by:



**The Society for
Polymer Science, India**

Abstract

Bone cavities may be formed due to accidents or may also be caused due to a tumor or an infection in the bone. Bone void fillers or bone grafts are materials that are used to fill and accelerate healing of defects or cavities formed in the bone. A variety of natural and synthetic materials (ceramics, polymers, metals) have been used as bone void fillers. While these materials have shown some effectiveness in bone void filling, these materials frequently cause post-surgical complications like secondary fractures. Thus, there is an active interest to develop novel bone void filling materials that overcome these limitations of existing materials. Silk fibroin, a natural polymer extracted from the *Bombyx mori* silkworm cocoon, has been explored as a promising material for bone void filling applications. In our study, we have demonstrated a patented protocol for producing silk fibroin microparticle scaffolds. These scaffolds have been designed to have appropriate pore size ($> 100\mu\text{m}$), interconnected porosity, excellent dry compression modulus ($> 100\text{MPa}$) and controlled rate of bioresorption. The scaffolds have been shown to be biocompatible as per ISO 10993, a global biocompatibility standard. The scaffolds show excellent differentiation of bone cells into an osteoblastic lineage as compared to any of the products used globally in this application. Further, the scaffolds have been implanted in a pilot clinical trial in patients and recovery for the patients has been phenomenal. The silk fibroin microparticle scaffolds are currently in second stage clinical trial in India, post which the product will be launched in the Indian market after securing appropriate regulatory approvals. The product is being commercialized by Serigen Mediproducs. Serigen is a CSIR-National Chemical Laboratory spin-off company supported by Venture Center.

About the speaker

Dr. Anuya Nisal is the Founder and CEO of Serigen Mediproducs, an innovation-driven tissue regeneration products company. Dr. Anuya did her Ph.D. in Chemical Engineering from Indian Institute of Technology, Mumbai and her masters in Materials Science and Engineering from University of Delaware, USA. She has prior experience of working as a Scientist in the GE Plastics John F. Welch Technology Center. More recently, she was a Principal Scientist at the Polymer Engineering and Science department at CSIR-National Chemical Laboratory (NCL). At NCL, she was leading a group performing scientific research in the areas of **polymers, biomaterials, medical devices and tissue engineering**. She has successfully led and executed several projects with government agencies such as CSIR, DBT, DST-SERB, BIRAC, etc. Her work has resulted in **27 peer reviewed journal publications and 7 patent families**. Serigen is the winner of several prestigious awards including 9th National Award for Technology Innovation in "Polymers in Public Health Care" 2019-2020, Finalist of National Bioentrepreneurship competition 2017, National winner of Empower TIE Women Global competition 2021. Dr. Anuya has been recognised through several awards including the Indian National Academy of Engineering – Young Entrepreneur Award 2020, Leaders in Innovation Fellowship from Royal Academy of Engineering, UK, 2019, VASVIK award 2021 and a TIE-BIRAC-WINER award for Women in Entrepreneurial Research in 2019.



About Dr. Keki Hormusji Gharda

Dr Keki Hormusji Gharda, is a pioneering Indian entrepreneur-scientist who built the engineering polymers, pigments, and agrochemicals industry in India through outstanding research and innovation and successfully brought products into the market.



Gharda Chemicals Limited (GCL), established in 1967, is a research-based company with four manufacturing units. Innovation through a vibrant R&D has marked the rise of GCL from a small unit in 1964 to one of the most successful and reputed companies in the agrochemicals industry. His vision for the company is to convert "knowledge through products into wealth for the good of society."

Between 1998-2005, GCL developed and commercialized polyaryl ether sulfones for the first time in India and Asia. This resulted in setting up a manufacturing plant at Panoli Gujarat. The quality of the technology and products was vindicated when a global major, Solvay, acquired this facility from Gharda Chemicals in 2005. GCL continues to be a pioneer in specialty polymers through R&D, applications development, and commercialization of new products. He directed the R&D and commercialized the first ever melt processible grades of PEKK in the world with varying molecular weights using a novel patented process with $T_m 395^\circ\text{C}$ and a 30% CF or GF reinforced compounds for export markets. This made GCL only the third global producer of these products. GCL has established a commercial process for manufacturing S-PEKK. Several intricate process related issues were resolved, such as separating S-PEKK from sulfuric acid and drying of the final product. GCL has developed a process to produce ABPBI fibers by wet-wet spinning from a highly acidic and corrosive solvent. This is again a first in the world. GCL is close to commence commercial production of poly(etherimide) and when this happens, GCL will become the second producer of this product in the world.

Dr. Gharda through sustained efforts has put India on the map of specialty polymers and demonstrated that Indian scientists are capable of developing world class products, many for the first time in the world, produced them commercially and exported the products to demanding customers in the most developed parts of the world. He has put India firmly amongst the few nations in the world with such capabilities in this range of specialty polymers

Dr. Gharda was born on 25th September 1929 and earned his BSc in Chemistry from Elphinstone College, Mumbai University, (1948) BSc (Tech) from University Department of Chemical Technology Mumbai (now ICT, 1950) followed by Masters in Chemical Engineering (1952) from the University of Michigan, Ann Arbor and PhD (1959) in Chemical Engineering from the same University. He moved to the University of Oklahoma, Norman, Oklahoma along with his thesis advisor at the end of his PhD work and continued there for an additional two years as an Assistant Professor. Upon returning to India, he began teaching at the University Department of Chemical Technology, Mumbai before venturing into his entrepreneurial journey.

Dr. Gharda was conferred with the coveted Padma Shri in 2016 by President of India for his pioneering contributions to the field of science, technology, and industry. He is a fellow of the Indian Academy of Sciences, Bangalore and was recognized by FICCI Award for Research and Technology Development and Commercialization of Poly Ether Ether Ketone (PEEK). He also received the American Institute of Chemist's 'Chemical Pioneer' award. Dr. Gharda has directed much of his wealth towards philanthropic activities via "The Abaan and Keki Gharda Memorial Trust," "Gharda Research Foundation" and "Gharda Institute of Technology" in Ratnagiri, Maharashtra.

Deeply knowledgeable, both, in chemistry and chemical engineering, Dr. Gharda has lived his life based on the credo "Earn honestly, live economically, spend generously and maximally for the community around, especially under privileged one."

About Gharda Award

Society of Polymer Science India (SPSI) announces the launch of the "Dr. K.H. Gharda Industrial Innovation Award in Polymer Science" from the year 2023. This is a newly instituted biannual award named in honor of Dr. Keki Hormusji Gharda, a pioneering entrepreneur who built the engineering polymers, pigments, and agrochemicals industry in India through outstanding research and innovation and finally brought products into the market.