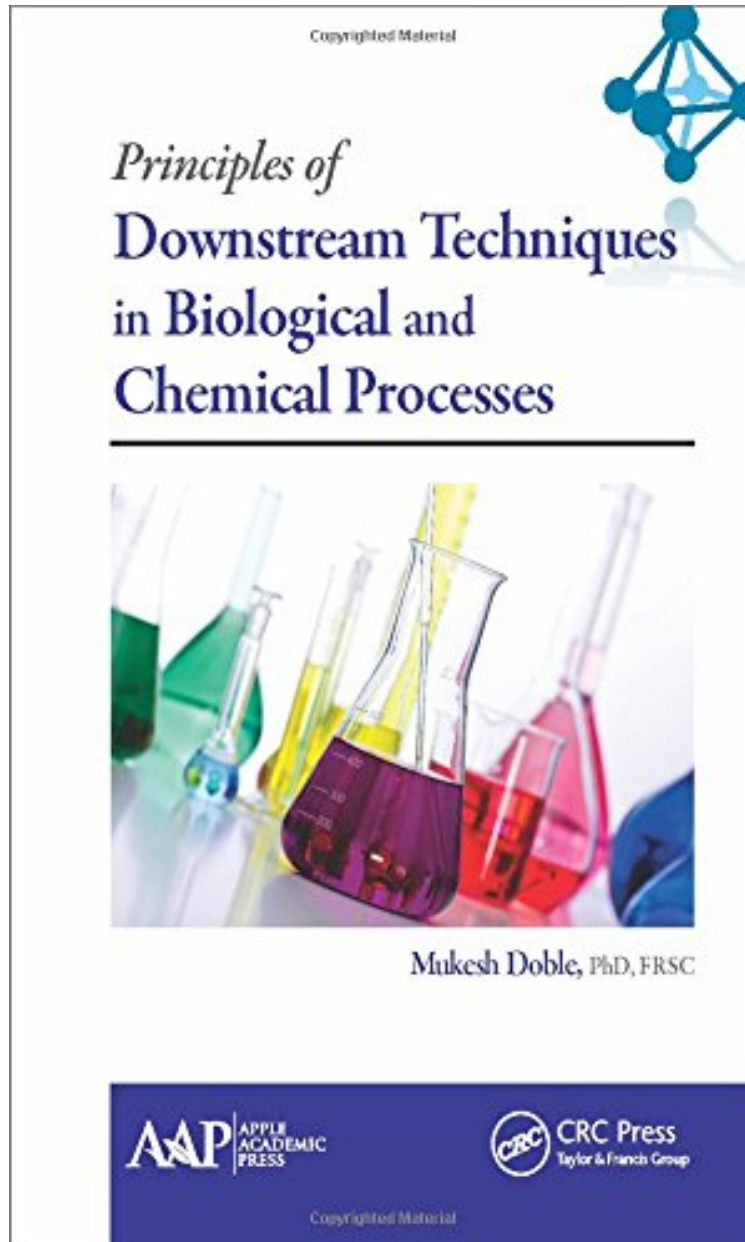


# Principles of Downstream Techniques in Biological and Chemical Processes

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## Downstream Techniques in Biological and Chemical Processes:

Downstream processing is an essential practice in the production and purification of biosynthetic materials, which is especially important in the production of pharmaceutical products. This book covers the fundamentals and the design concepts of various downstream recovery and purification steps (unit operations) involved in biochemical and chemical processes. The book describes cell breakage and recovery of intracellular material, isolation of solids, product recovery, product enrichment, and product polishing and finishing. It also covers basic chemical engineering purification techniques such as distillation, absorption, adsorption, etc. Described in the book are several case studies that discuss the various unit operation in each of the processes. An important point to consider is the economics of the downstream operation, and this book provides practical information on capital costs and operating expenses in addition to other operating cost factors with respect to downstream processing. Green chemistry and safety issues are also addressed. Practicing chemical engineers in biotechnology and pharmaceutical chemistry and other areas will find this book valuable as a reference on downstream techniques used in biological processes. Students in chemical engineering would benefit from this book as well.

About the Author Mukesh Doble, PhD, is a professor and head of the Department of Biotechnology at IIT Madras in Chennai, India. He has previously worked for 20 years at Imperial Chemical Industries (ICI) and General Electric (GE) Technology centers. His areas of interest are drug design, biomaterials, bioreactors, and bioremediation. He holds BTech and MTech degrees in chemical engineering from IIT, Madras, India, and a PhD from the University of Aston, Birmingham, UK, and postdoctoral at the University of Cambridge, UK, and Texas AM, Texas, USA. He has authored or coauthored 240 technical papers, seven books, including the books Cyclic Beta-Glucans from Microorganisms: Production, Properties and Applications; Drug Design, Basics and Applications; Green Chemistry and Processes; Biochemical Engineering; Biotreatment of Industrial Effluents; Biotransformations and Bioprocesses; and Homogeneous Catalysis: Mechanisms and Industrial Applications. He has filed six patents. He is a fellow of the Royal Society of Chemistry, London, and a recipient of the Herdillia Award for Excellence in Basic Research from the Indian Institute of Chemical Engineers and was named the Dow Professor M. M. Sharma Distinguished Visiting Professorship in Chemical Engineering at Institute of Chemical Technology, Mumbai, India. He is on the editorial board of the journal Chemical Engineering and a member of the American and Indian Institutes of Chemical Engineers.