

## Preface

Proteins have important commercial applications: as pharmaceuticals, food products, food additives, nutraceuticals and industrial catalysts, to name just a few. *Protein bioseparation* refers to the recovery, isolation, purification and polishing of protein products. It is often regarded as the critical limiting factor in the successful commercialisation of protein based products. An ideal protein bioseparation process must combine high productivity with high selectivity of separation, and must be feasible at mild operating conditions. All these requirements are met by *ultrafiltration*, which is a pressure-driven membrane-based separation process.

This book discusses how ultrafiltration could be used for protein bioseparation. There are several good books on protein bioseparation and indeed several others on ultrafiltration. However, there are relatively fewer books dealing specifically with protein bioseparation using ultrafiltration, in spite of this being an area with tremendous potential for growth and development. This book is primarily intended for academic and industrial researchers keen to explore the exciting possibility of using ultrafiltration for protein bioseparation. This book will also be useful for graduate students doing courses in the broad areas of biotechnology and membrane technology. It might be worth mentioning here that the principles and processes discussed in connection to protein bioseparation are also relevant to the bioseparation of other types of biopolymers such as nucleic acids.

From a protein bioseparation point of view, ultrafiltration is mainly used for protein concentration, diafiltration, clarification and fractionation. The first three mentioned here are established technologies, which have already found wide acceptance in the bioprocess industry. Protein fractionation using ultrafiltration is a new, exciting and challenging proposition, and has been dealt with in more detail in this book.

In Chapter 1 of this book, an overview on protein bioseparation is given. Its importance in the overall protein manufacturing process is highlighted and some of the commonly used techniques are briefly discussed. In Chapter 2, ultrafiltration is introduced to the reader. A membrane is the key component of an ultrafiltration process: Chapter 3 deals with membranes. Of almost equal importance is the membrane module, which is the device within which a membrane-based process is carried out. Chapter 4 highlights the role of the membrane module in an ultrafiltration process. Membrane *fouling* is widely regarded as the ‘Achilles heel’ of ultrafiltration. Chapter 5 discusses this problem. Membrane fouling is also discussed in subsequent chapters in the context of specific phenomena and processes. The productivity of an ultrafiltration process is largely determined by the *permeate flux*. Factors affecting permeate flux along with flux enhancement methods are discussed in Chapter 6. Another important aspect of protein ultrafiltration is the transport of proteins through membranes. This is dealt with in Chapter 7. Chapter 8 very briefly introduces the concept of selectivity. Chapters 9–12 deal with the different types of ultrafiltration based protein bioseparation processes, i.e., protein concentration, diafiltration, clarification and fractionation respectively. New developments and potential areas of further research and development are discussed in Chapter 13.

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