Part Two

Applications: Component and Phase Separation Processes

Part Two of this book is concerned with applications. It contains nine chapters and each serves a unique purpose in an attempt to treat nearly all the important aspects of mass transfer. A major objective of this part is to prepare the reader to solve real-world engineering and design problems that involve mass transfer unit operations.

There are various mass transfer operations. The three that are most encountered in practice are distillation, absorption, and adsorption. As such, they receive the bulk of the treatment in the early chapters. Other operations reviewed include, liquid–liquid and liquid–solid extraction, humidification and drying, crystallization, membrane separation processes, and phase separation processes. A brief introduction to each topic is provided below.

In distillation (Chapter 9), a liquid mixture at its boiling point is brought into contact with a saturated vapor mixture of the same components with a different concentration. The components are transferred between the phases until equilibrium is established or the phases are separated. In gas absorption (Chapter 10), a component in the gas phase is dissolved by a liquid phase in contact with it. The opposite of gas absorption is stripping, where a component of the liquid phase is transferred to the gas phase. In adsorption (Chapter 11), a component of a gas or liquid is retained on the surface of a solid adsorbent such as activated carbon. In extraction (Chapter 12), one makes use of solubility differences in different liquid phases. In humidification and drying (Chapter 13), water or another liquid is vaporized, and the required heat of vaporization must be transferred to the liquid. Dehumidification is the opposite of humidification, and is defined as the condensation of water from air, or, in general,

the condensation of any vapor from a noncondensable gas. In crystallization (Chapter 14), a solution of dissolved solids is supersaturated, and allowed to crystallize out the excess solute, thereby forming a more pure crystalline solid. Membrane separation processes (Chapter 15) utilize a semi-permeable physical barrier to achieve a separation. Finally, phase separation processes receive treatment in Chapter 16.

Problems for each chapter can be found online at www.wiley.com; follow links to this title.