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	Implementation and Simulation; 3.2.1 Spreadsheet Model; 3.2.2 Modeling using a Process Simulator; 3.3 Uncertainty Analysis 3.3.1 Scenario Analysis3.3.2 Sensitivity Analysis; 3.3.3 Monte Carlo Simulation; 4 Sustainability Assessment; 4.1 Sustainability; 4.2 Economic Assessment; 4.2.1 Capital-Cost Estimation; 4.2.2 Operating- Cost Estimation; 4.2.3 Profitability Assessment; 4.3 Environmental Assessment; 4.3.1 Introduction; 4.3.2 Structure of the Method; 4.3.3 Impact Categories and Groups; 4.3.4 Calculation of Environmental Factors; 4.3.5 Calculation of Indices; 4.3.6 Example Cleavage of Penicillin G; 4.4 Assessing Social Aspects; 4.4.1 Introduction; 4.4.2 Indicators for Social Assessment 4.5 Interactions between the Different Sustainability DimensionsPART II Bioprocess Case Studies; Introduction to Case Studies; 5 Citric Acid - Alternative Process using Starch; 5.1 Introduction; 5.2 Fermentation Model; 5.3 Process Model; 5.4 Inventory Analysis; 5.5 Environmental Assessment; 5.6 Economic Assessment; 5.7 Conclusions; 6 Pyruvic Acid - Fermentation with Alternative Downstream Processes; 6.1 Introduction; 6.2 Fermentation Model; 6.3 Process Model; 6.3.1 Bioreaction and Upstream; 6.3.2 Downstream Processing; 6.4 Inventory Analysis; 6.5 Environmental Assessment 6.6 Economic Assessment6.7 Conclusions; 7 I-Lysine - Coupling of Bioreaction Model; 7.4 Process Model; 7.5 Coupling of Bioreaction and Process Model; 7.4 Process Model; 7.5 Coupling of Bioreaction and Process Model; 7.5 1 Assumptions; 7.6 Results and Discussion; 8 Riboflavin - Vitamin B2; 8.1 Introduction; 8.2 Biosynthesis and Fermentation; 8.3 Production Process and Process Model; 8.3.1 Upstream Processing; 8.4.1 Inventory Analysis; 8.5 Ecological Assessment; 8.6 Economic Assessment; 8.7 Discussion and Concluding Remarks 9 a-Cyclodextrin
Sommario/riassunto	Bioprocess technology involves the combination of living matter (whole organism or enzymes) with nutrients under laboratory conditions to make a desired product within the pharmaceutical, food, cosmetics, biotechnology, fine chemicals and bulk chemicals sectors. Industry is under increasing pressure to develop new processes that are both environmentally friendly and cost-effective, and this can be achieved by taking a fresh look at process development; - namely by combining modern process modeling techniques with sustainability assessment methods. Development of Sustainable Bioprocesses: