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Stoichiometry of Microbial Growth and Product Formation

7.1. INTRODUCTION

Cell growth and product formation are complex processes reflecting the overall kinetics and stoichiometry of the thousands of intracellular reactions that can be observed within a cell. For many process calculations, we wish to compare potential substrates in terms of cell mass yield, or product yield, or evolution of heat. Also, we may need to know how close to its thermodynamic limit a system is operating. (That is, is product yield constrained by kinetic or thermodynamic considerations?) If a system is close to its thermodynamic limit, it would be unwise to try to improve production through mutation or genetic engineering.

Although the cell is complex, the stoichiometry of conversion of substrates into products and cellular materials is often represented by a simple pseudochemical equation. In this chapter we will discuss how these equations can be written and how useful estimates of key yield coefficients can be made.

7.2. SOME OTHER DEFINITIONS

In Chapter 6 we discussed the definitions of yield and maintenance coefficients, and we learned how to estimate their values using chemostat culture. In particular, we discussed the overall growth yield coefficient $Y_{X/S}^M$, which is the maximum yield of cell mass per unit mass of substrate consumed when no maintenance is considered.