3 Commercial Applications of Thermophile Bioleaching

CHRIS A. DU PLESSIS, JOHN D. BATTY, DAVID W. DEW

3.1 Introduction

The focus of this chapter is the commercial applications of thermophilic bioleaching technologies. Because of the prominent role of these applications, particularly in processing copper ores and concentrates, the commercial exploitation and technical features of the thermophilic technologies will be discussed in the context of this metal.

3.2 Commercial Context of Copper Processing Technologies

Before discussing the application of thermophile technologies, a brief overview of the competitive technical and commercial landscape is warranted. There are a number of processing options that could be considered when evaluating a particular copper mining project. A diagrammatic overview of the main processing options is given in Fig. 3.1. These processing options have important commercial implications and provide insights into the role of various technologies in selecting the most economically favorable processing route. The four main copper processing technology options are smelting, concentrate leaching, heap leaching and in situ leaching. A brief description of each technology is provided, followed by a delineation of the commercial niche for thermophile bioleaching technologies compared with other available processing technologies.

3.2.1 In Situ Leaching

In situ leaching is the only processing option that does not require the metal-containing material to be removed from the ground (Bosecker 1997; Liu and Brady 1999). In such cases a network of drill-holes is typically used to inject acidic solutions directly into the subsurface ore body where it percolates until reaching an impermeable layer. A secondary, deeper set of drill-holes is used for extraction of the pregnant liquor solution (PLS) to the surface for further processing. An important requirement for in situ leaching is an impermeable hydrogeological barrier layer immediately below the leaching
zone in combination with other containment measures, for obvious environmental reasons. The PLS is further processed by conventional solvent extraction and electrowinning methods to produce cathode metal of the desired grade (Kordosky 2002). Copper recoveries are relatively low, with leaching periods typically measured in years. This processing method is generally only a viable technology option for the recovery of copper from acid-soluble minerals, mainly copper oxides, with lesser success in recovery of secondary copper sulfides (chalcoite, Cu₂S and covellite, CuS), and is unsuitable for recovery of primary copper sulfides such as chalcopyrite (CuFeS₂). The economics of the process is governed principally by the copper grade, the size of the ore body, the recovery of the copper from the leaching material, and