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Bioprocess Considerations in Using Plant Cell Cultures

13.1. WHY PLANT CELL CULTURES?

The plant kingdom is very diverse. Many thousands of chemicals are produced only in plants. The biosynthetic capabilities of plant cells have been little explored. Only a few percent of the world's plants have been scientifically named or described, and only a small fraction of these have been screened for the production of novel and useful compounds. The great genetic potential of plants to produce compounds of use to humans has been little exploited. In fact, the rapid destruction of forests worldwide is leading to the extinction of many plants without preservation of their genomes.

Even the small number of characterized plants have yielded many important compounds (e.g., over 120 prescription drugs). In the Western world, over 25% of pharmaceuticals are derived from extraction from whole plants, and a much greater fraction of medicinals are plant-derived in Asia and the rest of the world. In addition to uses as medicinals, plant products are of interest as dyes, food colors, food flavors, fragrances, insecticides, and herbicides. Some compounds of potential commercial interest are listed in Table 13.1.

These compounds are chemically complex and are generally nonproteins. The compounds most likely to be of commercial interest are those that are not synthesized by microbes and are of sufficient complexity that chemical synthesis is not a reasonable alternative. Also, these nonprotein products are often made by the condensation of intermediates from separate pathways. Plant genetics and physiology are poorly