9.5 Health Hazards Associated with Extractives

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9.5.1 Introduction

"with juice of cursed hebona in a vial, and in the porches of mine ear did pour the leprous distillment; whose effect holds such an enmity with the blood of man..."

(Hamlet, Act I, Sc. IV.)

The story told by the dead king, of being murdered by his brother using hebona juice, leaves an indelible picture in the mind. Perhaps the reason for this is that the story was so well and succinctly told, or it may have been that the use of a natural product as a weapon made the story more horrible. The latter explanation may account for the success of the modern murder mystery. We are used to its victims being dispatched with a variety of natural poisons: from curare-tipped darts to tetrodotoxin-poisoned meals. Compounds such as curare and tetrodotoxin are toxic natural products of wide diversity and have many curious structures, chemically speaking. However, these compounds, which are extracted from leaves or puffer fish, are not included in the present survey. More commonplace exam-
amples of poisoning woods such as poison oak, poison ivy, and sumac (57) are known only too well. Thus, toxic (dermatological) effects are known to be caused by extractives present in the wood and bark of species much closer to home.

The toxic effect of wood extractives has sometimes been fatal; however, the toxins have generally been discovered after some instance of distress in workers or explorers. Such toxic effects were generally the first indication of the toxicity of particular classes of compounds that were extracted. The first examples were application route, whose action was across the skin - that is, transdermally. Senear (168) in 1933 reported on a case of dermatitis caused by exposure to Taxodium sp. Also, he surveyed the field and described 143 species of wood that were troublesome. For 54 years, his review has been a classic in this field.

A second application route was discovered when asthma or bronchial reactions were noted by many sufferers. Thus, the offending substances were acting through inhalation. A third method of introducing the toxins was by direct injection: the effects of curare and other poisons (68) have been described. Finally, all three possible application routes of intoxication (or a combination of them) may be necessary to cause the development of various cancers (121).

The natural consequence of these four toxic effects has been the study of their occurrence in woodworkers and others. The study of the toxic extractives in worker safety and industrial hygiene was essential to understanding the causes of disease and to preventing the effects from developing. Several early reviews in the field will be covered, but the book by Hausen (75) is the most recent, and best, comprehensive study.

The final section in this chapter traces the history of developments in this field and looks at future developments, research recommendations, and methods for designing such studies on the secondary metabolites of woody plants.

9.5.2 Toxic Extractives

9.5.2.1 Alkaloids and Amino Acids

There are very few alkaloids present in wood (75, 152), but they are, of course, found extensively in plants (143, 187, 188). There were many instances of toxic alkaloids in the ancient literature. The most infamous example was the use of coniine from poison hemlock, Conium maculatum, to kill the greatest philosopher of all, Socrates. The hemlock woods of commerce (Tsuga spp.) are not related to this species, and they do not contain coniine. Nowadays, more poisoning of livestock, rather than people, occurs as a consequence of alkaloid ingestion. Keeler (93) recently reviewed the many plant toxins and their effects on livestock. Various alkaloids from Magnolia spp. have been shown (152) to possess cytotoxic and antibacterial effects. There are several toxic non-protein amino acids, but only mimosine has been extracted from wood. The effects of this compound have been reported by Keeler (93). The comparative toxicity of some non-protein amino acids has been reviewed (70, 151).