Chapter 11

The Future of Wood Extractives

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11.1 Introduction

For many years visionaries have been forecasting a world in which a substantial part of the chemicals, fibers, plastics, and liquid fuels would come from the forest. Integrated factories featuring the production of cellulose for fibers and thermoplastics, terpenes for fine chemicals, phenolic polymers from bark for dispersants and adhesives, lignin pyrolysis for aromatic hydrocarbons, and so on, are readily imagined. Abundant raw material appears to be available. Bark, for example, which contains waxes, flavonoids, phenolic polymers, and a whole host of other compounds as described in preceding chapters, is estimated to be available worldwide in amounts exceeding one hundred million tons (dry basis) annually at wood products mill sites (13). Despite raw material availability and the ample technology reviewed in these pages, we are farther from the goal of effectively utilizing wood extractives than forty years ago when the wood-based chemical industry reached its peak (41).

Two examples are illustrative: Shortly after the turn of the century, one of the ten largest companies in the United States was totally dependent upon extractives for its raw material (23). The Central Leather Company, successor to the United States Leather Company, had tanneries scattered all over the state of Pennsylvania, each of which extracted tannin from the bark of the eastern hemlock (*Tsuga canadensis*). Today not only is it the only one of the ten companies no longer in existence, but there is not a single producer of native tannin in North America.

The gum naval stores industry showed a similar pattern. During 1908, the peak year of production in the United States, more than 120000 tons of spirits of turpentine and 600000 tons of rosin were produced. Due to competition from wood naval stores after World War I and sulfate turpentine and tall oil after World War II, gum naval stores production declined to less than 4000 tons in 1985. The United States government, recognizing the inevitable demise of this product, completed the liquidation of its stocks in 1972, terminated the Naval Stores Conservation Program, and closed the Agricultural Research Service's Olustee (Florida) Research Laboratory in 1973 (44).

If we were limited to these two examples, it might be concluded that the commercial future of wood-based extractive industries is doubtful. On the other hand, natural rubber production has continued as a major activity in a number of countries in spite of all the attempts to replace it with synthetic substitutes. Carbohydrate gums and mucilages continue to be collected, refined, and utilized in applications unimagined only a few years ago. Almost all of the world's tall oil and sulfate turpentine that can be conveniently captured is sold to fractionators who convert it to a myriad of saleable products and intermediates (Chap. 10.1).
In trying to forecast the industrial future of wood extractives, it is vitally important to identify reasons why some major segments have died, some have prospered and grown, and others with substantial potential did not even reach initial success in spite of substantial financial and technical backing. This should help us to focus our research on projects that are likely to bear fruit. Even more important, there is a good rationale for continuing and expanding wood extractives science quite apart from potential commercial exploitation of extractives. As pointed out in Chap. 9, wood extractives play a profound role in the pulpalibility of wood, the quality of pulp and paper products, the stability of lumber towards its environment, and the utilization of wood for decorative purposes. Indeed, the life and death of the forest is controlled by the trace chemical constituents that signal growth and senescence. There is, therefore, compelling reason to improve our understanding of not just the chemistry of extractives but their distribution, function, and possible manipulation through external factors. Therein lies the future direction that extractives research ought to take. To defend this thesis, elaboration will be made on the business requirements for successful extractives-based enterprises, reasons for some failed ventures, prognosis for existing extractives-based industries, and some new directions for both industrial-oriented and basic research.

11.2 Requirements for Future Wood Extractives Business Ventures

At the risk of stating the patently obvious to an industrial scientist, there are a number of requirements that must be met for any new extractives utilization project if it is to receive serious consideration by business. Since research and development budgets are usually tightly limited, management asks the project initiator to think through the probable consequences of the work even before the first major experiment is conducted. If the business venture resulting from the project meets a number of requirements, and there is a reasonable probability that the research can be successfully carried out within the time and equipment restraints of a given research facility, then, and only then, is the project likely to be funded. The wise researcher would do well, therefore, to keep the following objectives in mind when trying to gain support for a wood extractives project:

11.2.1 Low Investment Risk

In times of high interest rates, volatile currency exchange rates, and risk of continued inflation, no corporate executive is going to be interested in investing his money in a project that does not yield any better return than the purchase of securities or placing money in the bank. A current example of ignoring that principle is involved in the extensive efforts during the past decade that North American government and university researchers have devoted to wood utilization schemes for simultaneous production of furfural, benzene, ethylene and/or ethanol, and ener-