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third edition
CHEMICAL
PROCESS
INDUSTRIES

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AP-42 SECTION 5.4
CHARCOAL
REFERENCE NO. 2

McGRAW-HILL BOOK COMPANY

NEW YORK ST. LOUIS SAN FRANCISCO
TORONTO LONDON SYDNEY

TABLE 32.3 *Products from One Cord (4,000 Lb) Hardwood (In percent)*

Charcoal	25.2	Tar, oil	5.0
Crude methanol	1.9	Gas	18.3
Acetic acid or equivalent	2.9	Water, etc.	46.7

furnish merchantable timber, more than half of wood distilled being of scrap. The products given in Tables 32.1, 32.2, and 32.3 have a wide variety of applications.

Charcoal¹ Six large plants produce approximately half the annual volume of charcoal. It is a chemical-conversion product which, in addition to its present primary use as a recreational fuel, is consumed in the metallurgical industries as a reducing agent. It is also used in purification operations as activated carbon. See Fig. 32.6.

Methanol is an aliphatic alcohol (Fig. 38.10) employed as a denaturant for ethyl alcohol, an antifreeze for automobiles, a solvent, and a methylating agent and for formaldehyde (Chap. 34).

Acetic Acid (Chap. 38). Its applications are numerous. It is used in the preparation of a great number of the products of the process industries, including acetic anhydride, sodium acetate, cellulose acetate, ethyl acetate, butyl acetate, amyl acetate, white lead, and for dyeing and as a souring agent in textiles (Chap. 38).

Methyl acetone is a ternary azeotropic mixture, sold by the refiners as a solvent to the paint and lacquer manufacturers. The composition in practice runs between the limits of 25 to 30% methanol, 40 to 50% acetic esters, and 25 to 45% acetone.

Tar and oil The tar produced yields pitch, useful as a rubber softener on electrical insulation and in widely sold gasoline oxidation-inhibitor oils. Various grades of wood oils are employed as solvents, in wood preservation, and as insecticides. Some are purified and redistilled to yield guaiacol and wood creosote. Any residue is burned under the plant boilers.

Gas The gas evolved contains 53% carbon dioxide, 27% carbon monoxide, and 15% methane. It is burned to heat the retorts and to furnish part of the fuel for the boilers. It has an average heat content of 150 to 250 Btu/cu ft.

MANUFACTURE

RAW MATERIALS The hardwood-distillation industry of decreasing importance pyrolyzes all varieties of woods which are commonly classed as members of the broadleaf, or deciduous, species; i.e., oak, ash, birch, beech, hard and soft maple, hickory, cherry, eucalyptus, and chestnut. Only wood wastes are now commonly employed.

ENERGY REQUIREMENTS, UNIT OPERATIONS, CHEMICAL CONVERSIONS The principal chemical conversion is *pyrolysis*, or destructive distillation. In this industry, although the pyrolytic reactions require considerable energy in the form of heat to reach the temperature of reaction, certain later stages are exothermic. Many unit operations are involved to make the chemical conversions of pyrolysis function and to separate and purify the products of the pyrolysis. Among these are *heat transfer*, *condensation*, *distillation*, and *extraction (liquid-liquid)*. Much energy, mainly as steam heat, is required to carry on these operations. The modernization and improvement of the wood-distillation

¹Locke, Chemical Conversion Products from Wood, 5th World Forestry Congress, Seattle, 1960 (reprint from Forest Products, Madison, Wis.).