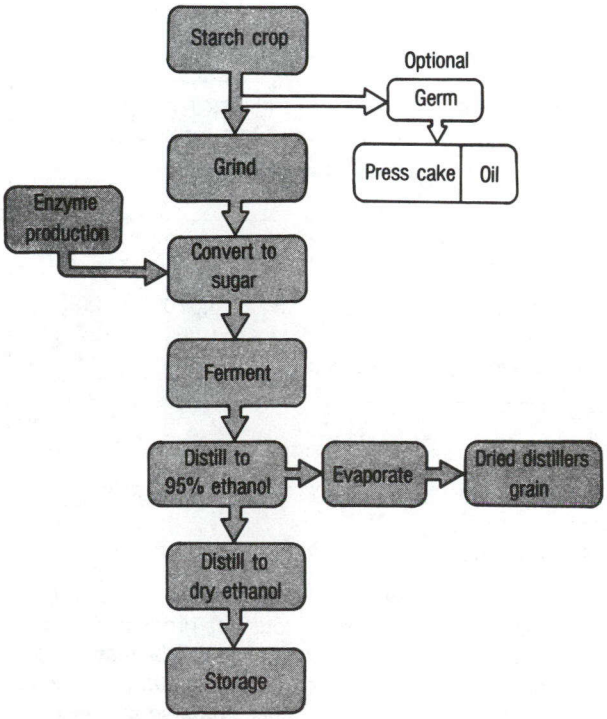
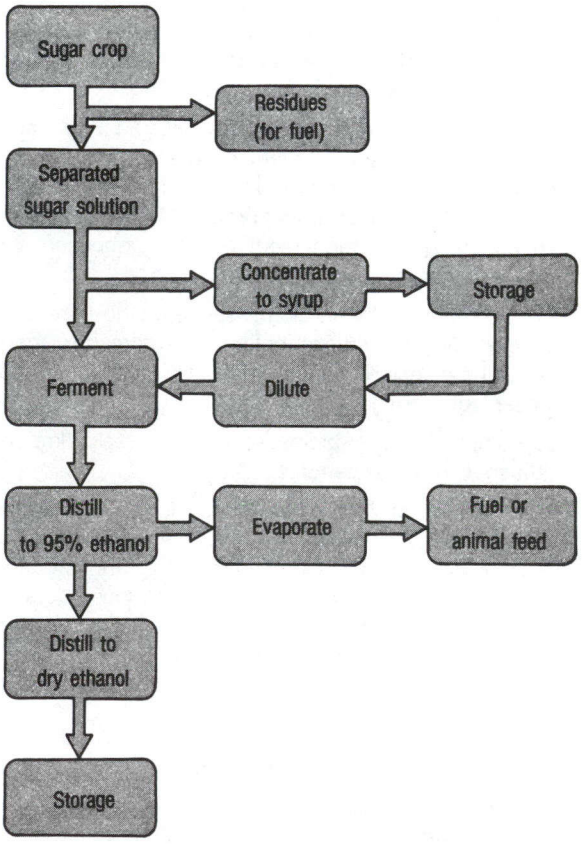
Figure 6-3: PROCESS DIAGRAM FOR THE PRODUCTION OF FUEL ETHANOL FROM STARCH-CONTAINING CROPS



Source: United States, Office of Technology Assessment, 1980b, p. 160.

Figure 6-4: PROCESS DIAGRAM FOR THE PRODUCTION OF FUEL ETHANOL FROM SUGAR-CONTAINING CROPS



Source: United States, Office of Technology Assessment, 1980b, p. 160.

plants such as sugarcane, sweet sorghum, sugar beets, mangels and Jerusalem artichokes. The two processes for producing ethanol from starch and sugar feedstocks are shown schematically in Figures 6-3 and 6-4.

The attractiveness of ethanol derives from the fact that it can be used directly as a portable liquid transportation fuel or it can be mixed with gasoline to produce gasohol. In either case, it reduces demand for gasoline.

Mohawk Oil is the first company in Canada to produce gasoline-ethanol fuels. This company will be using ethanol, manufactured from damaged or surplus agricultural crops at the rate of approximately two million gallons per year (roughly 155 barrels per day) in a revamped distillery, to produce gasohol for sale in retail outlets in Manitoba.

The proposal to make ethanol from *cellulose* is very appealing as it would allow exploitation of Canada's substantial cellulosic biomass resource, including wood wastes, spruce-budworm and fire-damaged wood, for feedstock. This resource is much larger than that represented by our starch and sugar crops and our food processing wastes combined, and its exploitation would avoid using food crops for energy production. Unfortunately, there are problems in breaking down cellulose to sugars which can be fermented to ethanol.

Wood

Wood is composed primarily of cellulose, hemicellulose and lignin. Cellulose can be broken down to sugar and then fermented to alcohol. Hemicellulose, on the other hand, is composed of 5-carbon sugar (pentose) subunits and is more difficult to convert to ethanol. Researchers at the NRC have, however, made good progress in developing organisms capable of pentose fermentation. Lignin binds the woody material together, makes the cellulose difficult to hydrolyze and is itself not fermentable to alcohol.

A new process has been developed in Canada whereby cellulosic material is steam exploded to open the wood structure and make the cellulose accessible for hydrolysis. This technique, together with the development of new hydrolytic enzymes, new genetically-engineered fermenting organisms and new ways of separat-