Abstract
Ethanol yields from some feedstocks are summarized in Table 1. The data are the representative values reported in literature or obtained in the author's own laboratory and are based on the gross weight of the unprocessed raw material. The actual yields depend on the carbohydrate contents and their forms in the feedstock. Even for a given feedstock, the form and contents of carbohydrates vary depending on the crop or plant line. Thus the above data should be regarded as just approximate values. The choice of feedstock should not be based on only the potential ethanol yields but also on the productivity (the easy with which they can be converted to ethanol) and ethanol production costs. There are no reliable data for comparison of ethanol productivity from the various feedstocks. The reported productivities vary greatly depending on the process used. However, the trend is that higher productivities are reported for sugar crops, followed by starch materials while the cheapest and more abundant lignocellulosic materials are more difficult to hydrolyze, resulting in much lower productivities. The process strategies for efficient production of ethanol from these feedstocks are discussed in part two of this chapter. With the present technology, the cost of ethanol production is not competitive with the current prices of gasoline. Bioenergy is still less than 5% of total energy used in most countries and aside from a few countries such as Brazil, ethanol is only a small percentage of the total bioenergy. Even in the United States (the higher ethanol producing country), ethanol makes up only about 1% of the total gasoline used. Since the cost of sugar crops are high, development of efficient systems for ethanol production from lignocellulosic materials is more promising. However, there is still need to optimize the pre-treatment step, improve the efficiency of enzyme hydrolysis to replace the use of expensive and environmentally unfriendly acid hydrolysis. This can be achieved by screening for, and developing strains that produce high active cellulose efficiency and developning efficient processes for enzyme production and hydrolysis. Also for efficient SSF, there is a need to improve the thermostability of the ethanol producing strains, and developing strains that can efficiently ferment both hexose and pentose sugars or still better, strains that can ferment cellulose directly to ethanol. However, technology development and improvement alone may not be enough to make the fuel ethanol competitive with the current price of gasoline, at least in a very near future. Thus, energy policies that consider environmental issues and non-renewable nature of petroleum are needed before ethanol can be generally used as an alternative liquid fuel.