OVERVIEW OF CANADIAN THERMOCHEMICAL BIOMASS CONVERSION ACTIVITIES

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ABSTRACT

Canadian federal biomass thermochemical conversion R&D activity is funded primarily through Energy, Mines and Resources' Bioenergy Development Program. A number of pyrolysis technologies have been developed to the commercial or pre-commercial stage and their status and developments will be reviewed. Research strategies are focusing on the testing of various feedstocks, especially those presenting environmental disposal problems, and determining the near term opportunities of using the pyrolysis products for fuel and activated charcoal, and progress in this area will be discussed. In the mid term, the production of value added chemicals offers the most significant opportunity for the commercialization of these technologies, and this is another major R&D priority. A number of processes have been developed to isolate chemicals found in significant quantities in the pyrolysis oils, such as levoglucosan, aldehydes and acids. Research is now focusing on the optimization and scale-up of these isolation/separation techniques. The identification of market opportunities for these chemicals is another major research priority. The various activities, results and future directions of the research underway in this area will be presented. Gasification technologies received considerable research support a decade ago, but because of the lack of interest from industry, research is continuing at a low level in areas of commercial potential that still require further technical advancement, such as gas clean-up for firing into gas turbines, and program activities will be discussed.

INTRODUCTION

Biomass currently provides approximately 7% (540 PJ) of the total energy demand in Canada. This energy is supplied almost exclusively from the combustion of wood waste and pulping liquors to provide process heat and electricity to the forest products industry and from the combustion of wood for space heating in the residential sector.

A large potential exists for bioenergy to increase its contribution to the Canadian energy scene, particularly in light of the current concerns over the negative environmental impacts associated with the use of fossil fuels for energy and the
problems of properly disposing waste materials. As an example, ethanol derived from lignocellulose has been shown to reduce greenhouse gas emissions and to improve urban air quality through the reduction of carbon monoxide emissions when added as a 10% blend to gasoline.

The purpose of this paper is to provide an overview of thermochemical conversion activities in Canada considering issues such as feedstock supply, the current status of technical developments.

FEEDSTOCKS

There exists a varied and abundant biomass resource base which could be utilized to produce renewable energy sources and petrochemical replacements. However, when looking at these feedstocks for thermochemical conversion processes, it is apparent that a number of feedstocks cannot be considered at this time because of economic constraints.

Grains are now being used to produce ethanol through fermentation, and also a number of high value by-products including distiller's dried grains, gluten and potentially, human food products. The current prices of these materials however, preclude them from being utilized on any large scale for thermochemical conversion processes. While there is a large amount of agricultural residues available, there is still a cost associated with collection and transport to a bioenergy facility. As such, it is not expected that there will be significant opportunities to utilize them in thermochemical energy production scenarios. Energy prices are still too low and there is no environmental push at this time to have these residues disposed of in a different manner.

Wood residues are considered to have the best potential for sustaining large scale bioenergy industries. A recent government study has estimated the potential supply of waste biomass to be 2700 PJ, with mill residues accounting for 700 PJ and forest wastes the remaining 2000 PJ. In terms of availability, it is estimated that approximately 8 million odt/y is available as mill residues (sawdust and chip fines) while 26 million odt/y is available from logging residues. Another major advantage of wood residues are that they have already been collected and are available at central locations, at low or zero costs. As such, these waste will make an important contribution as a feedstock in the short to medium term.

The supply of forest residues for energy from conventional forestry provides a tremendous opportunity for biomass to make an important contribution to the Canadian energy picture. Work is focusing on developing systems for harvesting wood for energy from conventional forestry in conjunction with traditional logging assortments in one pass operations. Commercial integrated harvesting operations could reduce the cost