Pyrolysis in Finland

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Abstract

The pyrolysis of biomass has been applied industrially in the production of coke from peat in Finland. Other related industrial utilization schemes include gasification of wood residues and peat. Research has been focused during this decade on high-pressure conversion of peat and black liquor, flash pyrolysis of bark, lignin, and peat, and hydrotreatment of peat pyrolysate. All experimental work is on the laboratory scale in batch or continuous units. Strong emphasis has been placed on international cooperation, and that is expected to continue.

The paper discusses also the results of a techno-economic assessment of direct biomass liquefaction processes converting wood and peat to gasoline and diesel fuels. The study was carried out by the working group of the International Energy Agency, Direct Biomass Liquefaction Activity, in which Canada, Finland, Sweden and the USA participated. The potential for future cost reduction through research and development was clearly demonstrated for both flash pyrolysis and high-pressure conversion. The atmospheric flash pyrolysis, however, was considered as the preferable route for further research, since the risks involved were assessed to be smaller than with other technologies.

The Energy Department of the Ministry of Trade and Industry has launched 10 national energy research programmes. Their combined estimated cost during 1988–1992 is about 600 million Finnish marks.
corresponding to about 130 million ECU. Five programmes deal with energy production, two of which include aspects related to pyrolysis.

1 INDUSTRIAL APPLICATIONS OF PYROLYSIS

The two most important technologies applied commercially, where pyrolysis plays an important role, are carbonization and gasification.

There are two commercial carbonization plants in Finland [1]. Vapo Inc. has a plant using sod peat at Haukineva with a capacity of 30,000 t/year. Wood may also be fed to the process. By-product gases and tars are utilized in a boiler, and electricity (12 MW) and district heat are produced. Other by-products are peat briquettes (max. 40,000 t/year). Both the raw material dryer and the reactor are rotary kilns. The plant was designed and constructed by Outokumpu Inc.

The charcoal is used in the production of silicon and ferrosilicon. Minor amounts are used as barbecue charcoal and absorption material. The production of activated carbon has also been studied [2]. Carbonization was studied experimentally at VTT before the construction of the Haukineva plant. The reactor was a shaft furnace, and its capacity was around 30 kg/h of coke.

Rautaruukki Inc. is producing metallurgical coke from coal for its own steel mill at Raahe. The plant went on-stream in 1987. The reactor is a shaft furnace and was designed by a company from the Soviet Union. The pyrolysis gases are combusted at the plant. The tar is condensed, and transported to the Federal Republic of Germany for further upgrading.

The gasification of wood and peat has developed rapidly during the last decade in Finland. Kemira Inc. built a High Temperature Winkler (HTW) gasifier at Oulu in their fertilizer plant. Synthesis gas is produced from 25 t/h peat (about 130 MW) yielding 80,000 t/year ammonia. The plant was started up in 1988 [3].

A. Ahlström Corporation manufactures both circulating fluid-bed and fixed-bed gasifiers for biomass. Four Pyroflow plants have been built for the production of fuel gas from sawdust and bark for lime kilns (in Finland, Sweden and Portugal) [4]. About 10 fixed-bed Bioneer gasifiers using woodchips and sod peat have been installed for district heating boilers or industrial dyers. One unit has been installed in Italy, where MSW is gasified.