Termisk forgasning af biomasse: Sammenfatning af aktiviteter på DTU

The title of this Ph.D. thesis is: Thermal Gasification of Biomass. Compilation of activities in the "Biomass Gasification Group" at Technical University of Denmark (DTU). This thesis gives a presentation of selected activities in the Biomass Gasification Group at DTU. The activities are related to thermal gasification of biomass. Focus is on gasification for decentralised cogeneration of heat and power, and on related research on fundamental processes. In order to insure continuity of the presentation the other activities in the group, have also been described. The group was started in the late nineteen eighties. Originally, the main aim was to collect and transfer knowledge about gasification of straw. Very quickly it became clear, that knowledge was insufficient and the available technology, in most cases, unsuitable for converting the Danish biomass. The need for such technology was politically motivated, and therefore research and developing activities were initiated. In this thesis the research activities and development activities have been described. The combination of these two types of activities is complex and difficult, but it is concluded, that the combination of these activities has been fruitful. The two-stage gasifier was developed for gasification aiming at decentralised cogeneration of heat and power. The development ranged from lap-top scale equipment to a fully automatic plant with more than 2000 hours of operation. Compared to most other gasification processes, the two-stage process has the advantages that it is producing gas with practically no tar, and the energy efficiency is high. Work on plants based on the two-stage process, has been initiated in several locations worldwide. A number of fundamental process-related subjects have been carried out. This have been related to etc. pyrolysis, char gasification, mathematical modelling, the use of additives to improve the characteristics of the ash, gas clean up, heat transfer in char and tar decomposition. It has been found that the tar decomposition in the two-stage process is carried out in two steps, in the partial oxidation process after the pyrolysis, and in the char bed. The operation of the two-stage gasifier showed that gas from this process was an excellent engine fuel. A spin-off process, the Low Temperature Circulating Fluid Bed Gasifier (LT-CFB) process is now the object of intense research and development. The advantages of that process is, that the main parts of the inorganic species from the biomass, which are undesirable in the power plant, is deposed in the ashes in the gasifier without the use of gas cleaning equipment. Originally the purpose of the activities was to find gasification processes, which “once and for all”, solves the main problems related to gasification, namely tar in the gas and deposits and corrosion caused by the ashes. It is concluded, that this is fulfilled. The perspective of the activities that have been completed up to now is that the two-stage process will find worldwide use for decentralised cogeneration plants and that the LT-CFB gasifier will find worldwide use for gasifying "difficult" biomasses.

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