Development of an online tar measuring method for quantitative analysis of biomass producer gas.

M. Ahmadi, K. Sjösrtöm , C. Brage and T. Liliedahl
KTH (Royal Institute of Technology), Chemical Engineering and Technology, Chemical Technology, Teknikringen 42, SE-10044 Stockholm ,Sweden
**Tel: +46 8 790 66 04, Fax: +46 810 85 79, e-mail: mahmadi@kth.se*

Introduction

Biomass gasification offers the potential for producing a fuel gas that can be used for power generation or synthesis gas applications [1]. Tar formation is a major problem in biomass gasification system and tar removal has been a major research topic over last decades and many methods have been proposed ranging from in –situ prevention of tar formation to secondary cracking of tars over a bed of catalyst [4]. Some of the tar compounds are extremely stable and difficult to eliminate by catalytic decomposition [1]. The measurement of the tar content in crud and cleaned gases is a decisive part of the operation of gasifiers and tar removal equipment. Conventional sampling method based on cold trapping [3] followed by solvent extraction/evaporation and final determination by weight or gas chromatography are time consuming, cumbersome and always discontinuous, i.e. offline. The SPA (Solid Phase Adsorption) method developed by KTH Sweden [5] is the fastest off-line method today. Online tar measuring method is a fully continuous tar measuring technique and gives a feedback of the gasification process.

Materials and Methods

To develop the online tar measuring method, a PID (Photo Ionization Detector) is used. The PID is a commercial product for volatile organic compound (VOC). The ultraviolet light source or lamp is the essential part. The wavelength of the light emitted depends on the type of gas inside the lamp. Wavelengths emitted by argon correspond to an equivalent of 8.4 eV respectively. Different tar components are detectable by this lamp. For instance: Naphthalene, Acenaphthene, Flourene, Anthracene, Pyrene and other aromatic compounds that have an ionization potential under 8.4 eV. In an ongoing work a PID analyzer is used to determine the performance of the gasifier and/or gas cleaning device. PID is connected to an atmospheric, fluidized biomass gasifier, fed with birch [2].

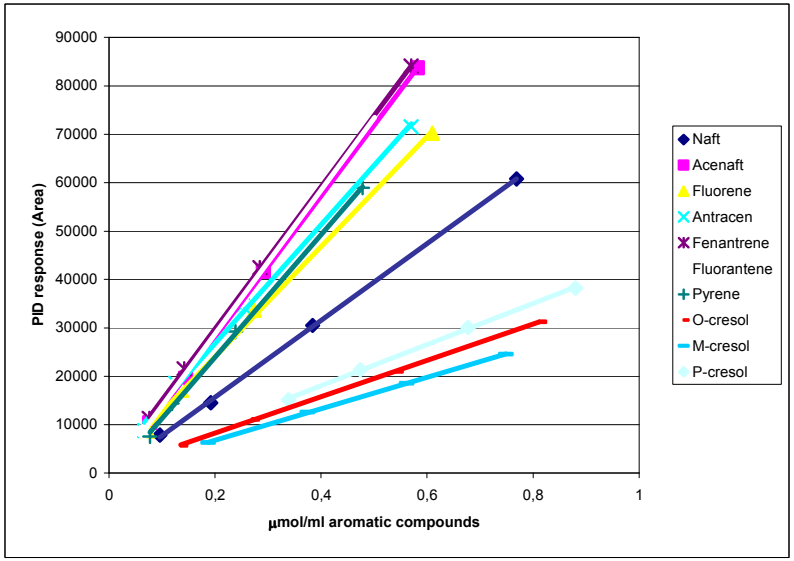
Results and Discussion

The influence of measuring temperature and presence of various other components in the gas is determined. We are developing a technique to prevent fouling of the lamps by tar condensation effects or other constituents in the gas and to adjust tar level to the range of acceptable concentration for the PID. The gas produced by the gasifier after thermal cracking at 850 ºC contains certain amount of tar such as Naphthalene, Anthracene, Flourene [1] and response factors of these individual tar components are determined.

Significance

The method can be used for process control and can be used as a safeguarding tool for expensive process equipment and/or prime mover. The method is easy to operate and investigate. It will contribute and enhance the development of tar-free gasification concepts.

Figure 1. Response factors of pure aromatic compounds measured by GC.



References

1. Myren, C., Hörnell, Ch., Björnbom, E., and Sjöström, K., *Biomassa & Bioenergy* 23, 217 (2002)
2. Heginuz, E., Lic. Thesis, KTH - Department of Chemical Engineering and Technology, Chemical Technology. SE-100 44 STOCKHOLM, (1999).
3. Chunshan, L., Kenzi, S., *Renewable and Sustainable Energy Reviews* (2008)
4. Ma, L., Verelst, H., Baron, G. V., *Catal. Today* 105, 729 (2005).
5. Brage, C., Qizhuang, Y., Guanxing, Ch., and Sjöström, K., *Fuel* 76,142 (1997)