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EXPERIENCE WITH OPERATION OF TWO-STAGES FIXED BED GASIFIERS

Siarhei SKOBLIA¹, Zdeněk BEŇO¹, Jiří BRYNDA^{1, 2}, Michael POHOŘELÝ^{1, 2}, Ivo PICEK³

¹ Department of Gas, Coke and Air Protection, ICT PRAGUE, Technická 5, 166 28 Praha, Czech Republic
Email: skobljas@vscht.cz

² ICPF ASCR, Rozvojová 1/135, 165 02 Praha 6-Suchbát, Czech Republic

³ TARPO Ltd., Pražská 346, Kněžves 270 01, Czech Republic

Space separation of different chemical processes (pyrolysis, oxidation, and char reduction) in separated generator chambers enables overcoming the typical limits of the fixed bed gasification. The using of a multi-stage process allows to increase the cold gas efficiency (CGE) and simultaneously improves the gas quality mainly focused on the reduction of tar concentrations on a level acceptable for internal combustion (IC) engines.

The presented work describes the specific design and operational characteristics of the two-stage gasifiers developed by Tarpo Ltd. The article contains the operation parameters, typical gas and tar composition, for different operation conditions, shows the effect of power output and properties of wood chips to gas quality. The prototype units GP200 (200 kW_e) have been used since early 2012. The facility consists of external biomass dryer and pyrolysis, partial oxidation (POX) and char reducing chamber integrated in one generator body. Raw gas was cleaned from dust by candle ceramic filters (390-490°C), cooled and used for the operation of two IC engines (CKD 6S160). Long term experiments (more than 3000h) showed perfect gasifier stability, the LHV of raw gas varies from 5.5 to 6.5 MJ/m³, tar content from 0.5 to 50 mg/m³ depending on POX temperature (1000-1200 °C) and operating conditions. The overall electrical efficiency was 27 %. The first commercial project (Odry, CR) started the operation by the end of 2012. There are two generators (GP500) with a maximal operation output of 550 kW_e provided by modern cogeneration units based on IC Jenbacher J316. The overall electrical efficiency reaches to 32 %. The biggest commercial application in Kozomin (CR) has 5 generators GP750. Two generators will be used only for syngas production for heat application and three for electricity production (3x710 kW_e, Jenbacher J320). Specific construction design of two-stage generator Tarpo Ltd. provides good thermoconversion efficiency, power flexibility and acceptable gas quality for modern IC engine operation.

Keywords: Two-stage biomass gasification, wood chips, gas composition, low tar.

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