PERGAMON

Biomass and Bioenergy 21 (2001) 445–460

BIOMASS & BIOENERGY

www.elsevier.com/locate/biombioe

# A study on a multi-stage hybrid gasifier-engine system

S.C. Bhattacharya *, San Shwe Hla, Hoang-Luang Pham

*Energy Program, School of Environment, Resources and Development, Asian Institute of Technology, P.O.Box 4, Klong Luang, Pathumthani 12120, Thailand*

Received 27 March 2000; accepted 14 August 2001

**Abstract**

This paper presents the results of a study on a multi-stage hybrid biomass–charcoal gasification to produce low tar content gas for engine application using coconut shell as a fuel. The performance of a gasifier-engine system consisting of the hybrid biomass–charcoal gasifier, a gas cleaning/cooling system and a diesel engine is also discussed.

The lowest tar content found in hybrid coconut shell-charcoal gasification was 28 mg N $m^{-3}$. Using a spray tower, producer gas could be cooled down to 40°C; almost tar-free gas was obtained after cooling the producer gas from the hybrid gasifier system. A three-cylinder Perkins diesel engine was tested at a constant speed of 1500 rpm on diesel alone and dual fuel modes of operation. A maximum of 81% of the total heat energy input was replaced by the producer gas at an electricity generation of 11.44 kWe. 

*Keywords:* Multi-stage; Gasification; Coconut shell; Tar content; Gas composition; Diesel engine; Dual fuel