Experimental investigations with a modified briquetting press as feeding system for the next generation pressurized gasifiers

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Overview

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1. Introduction

Aim of the investigation:

- next generation gasifiers (up to 65 bar) require novel feeding systems
- test of various technical solutions as an alternative lock-free continuous feeding system

Disadvantages of currently used feeding systems:

- discontinuous operation mode (use of locks)
- apparatus complexity (wear and sealing problems)
- no optimal energy efficiency using transport gas

- optimistic forecast for briquetting press as feeding system
- adaptation of well known agglomeration process for new purpose
Feeding system at ITUN:

before tests with feeding system, the basic laboratory scale research is required

- material parameters
- operation parameters
- press channel geometry

for maximum gas tightness of briquettes

pressure vessel:
- volume 250 l
- gas pressure 65 bar

briquetting press:
- high feeding pressure (up to 2000 bar)
- high cross-bracing in the press channel
  (≈ 30 % of axial pressure)
- high throughput, operation without locks
2. Basic research on the test rig

Simulation of the briquetting press with open press channel
Creation of and gas flow measurements through briquette plug

- cross-bracing measurement in the press channel (variation of internal geometry)
- gas tightness measurements of the briquette plug
- investigation of the briquetting parameters influence
Basic research was carried out with brown coals from the most important German brown coals deposits:

- Lusatian brown coal from East-Germany (Vattenfall)
- Middle-German brown coal (Romonta and Mibrag)
- Rhineland brown coal from West-Germany (RWE)

Gas flow measurements under variation of material and operating parameters:

- grain size: 0-1 mm, 0-4 mm
- water content: 13 - 20 %
- briquetting pressure: 1000 - 1800 bar

Optimum gas tightness of the briquette structure:

grain size 0-1 mm, water content 20 %, briquetting pressure max. 1400 bar
3. Feeding of coal into pressurized vessel

Knowledge from basic research used for adaptation of briquetting press as feeding system:

- optimum briquetting parameter constellation for gastight briquette structure
- optimum press channel geometry for various coal types

**Primary goal:** stable briquetting pressure profile in the press channel without fluctuations

![Test rig and briquetting pressure](image)
Romonta coal - grain size 0-1 mm, water content 13%

- increase of briquetting pressure after pressurizing the vessel
- briquetting pressure drop after gas pressure release from the vessel

Pressurizing the vessel

\[ \Delta p \approx 150 \text{ bar} \]

Desired pressure level

Gas

65 bar

Conical outlet

Restriction

Briquetting pressure

More cross-bracing through gas pressure

More friction in the channel \( \rightarrow \) more pressure
Romonta coal - grain size 0-4 mm, water content 13%

The research results provide the evidence for use of briquetting press as an alternative continuous lock-free feeding system for pressurized gasifiers!

No gas pressure drop in the vessel or gas leakage through transport channel!
4. Summary

• aim of research was the test of briquetting press as alternative feeding system for pressurized gasifiers

• hypothesis for use of briquetting press as feeding system was confirmed

• feeding of brown coal into pressurized vessel was carried out with Romonta coal: 0-4 mm and 0-1 mm, 13 % water

• successful coal feeding against 60 - 65 bar gas pressure (15min.)

• no gas pressure drop in the vessel or gas leakage through transport channel could be registered

• further investigations with other brown coal types
Thank you for attention!