

Plasma Gasification for Toilet Challenge

Guido Sturm, Georgios Stefanidis

Delft University of Technology, Process & Energy Laboratory,
Intensified Reaction & Separation Systems, www.pe.tudelft.nl

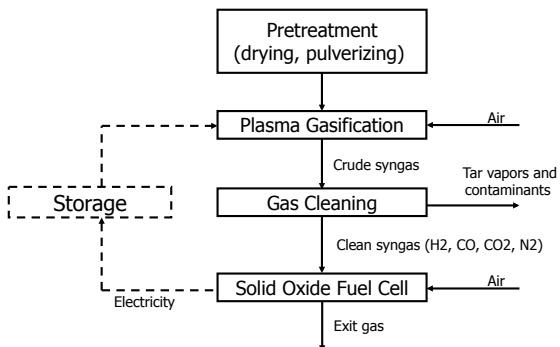
Background



- 2.6 billion people lack access to adequate sanitation globally.
- Just in Africa, 115 people die every hour from diseases linked to poor sanitation, poor hygiene and contaminated water.
- The Gates Foundation supports development and deployment of innovative and affordable technologies that can radically improve sanitation in the developing world.

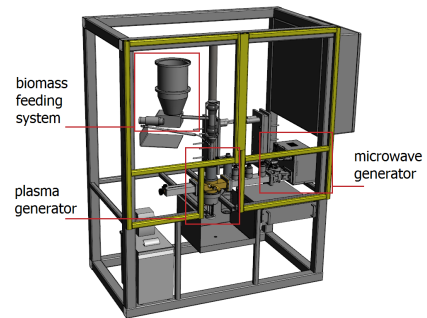
The TU Delft process

The TU Delft focuses on novel gasification technology by means of a **microwave generated plasma**. After a pre-treatment step – drying and pulverizing –, the biomass is exposed to the hot and reactive plasma which converts it to syngas (hydrogen and carbon monoxide), which is then first cleaned and subsequently used to fuel a solid oxide fuel cell for energy recovery.



Process diagram

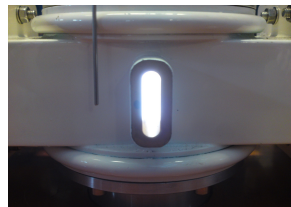
Plasma gasification



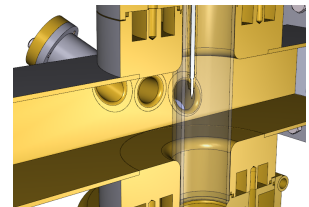
Plasma setup design

Challenges: develop a system that,

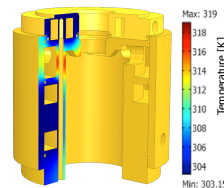
- Enables continuous feeding of biomass into a microwave generated plasma
- Does not a) leak toxic gasses, b) emit microwave fields, or c) melt.
- Enables reliable and stable **ignition** and **operation** of plasma for process applications.



Plasma in operation



TU Delft developed ignition system



Simulation of cooling performance

Status

- Preliminary results show that gasification produces gas that is rich in syngas. More energy in terms of syngas is released than is expended in terms of microwave energy.
- The newly designed plasma setup is currently in production.