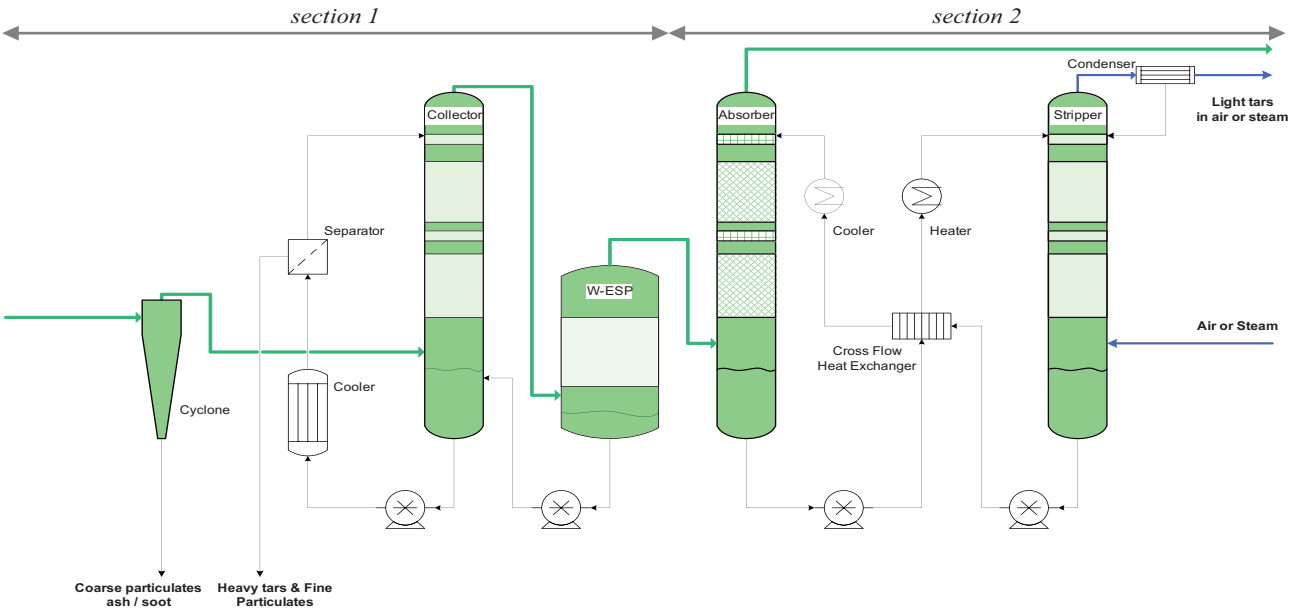
ECN

Energy research Centre of the Netherlands

Principle of OLGA tar removal system

The tar removal principle of OLGA is based on a multiple stage scrubber in which gas is cleaned by special scrubbing oil. In the 1st section of OLGA the gas is gently cooled down by scrubbing oil. Heavy tar particles condense and are collected, after which they are separated from the scrubbing oil and can be recycled to the gasifier, together with a small bleed.

In the 2nd section lighter gaseous tars are absorbed by scrubbing oil. In the absorber column the scrubbing oil is saturated by these light tars. This saturated oil is regenerated in a stripper. Hot air or steam is used to strip the tars of the scrubbing oil. All heavy and light tars can be recycled to the gasifier where they are destructed and contribute to the energy efficiency. Tar waste streams are efficiently recycled this way.

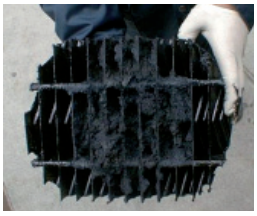


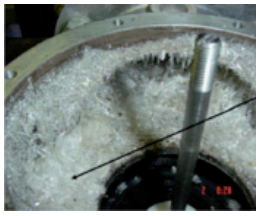
The tar problem

The presence of tars in the product gas is a big problem in the commercial utilisation of biomass product gas as source of sustainable energy. Tar is formed in the gasifier and comprises a wide spectrum of organic compounds, generally consisting of several aromatic rings. Simplified tars can be distinguished in heavy tars and light tars.

Heavy tars condense out as the gas temperature drops and causes major fouling, efficiency loss and unscheduled plant stops. The tar dew point, i.e. the temperature at which tars start to condense, is a critical factor.

Light tars like phenol or naphthalene have limited influence on the tar dew point, but are not less problematic. Light tars like phenol chemically pollute bleed water of downstream condensers and aqueous scrubbers. Naphthalene is important as it is known to crystallise at the inlet of gas engines causing a high service.





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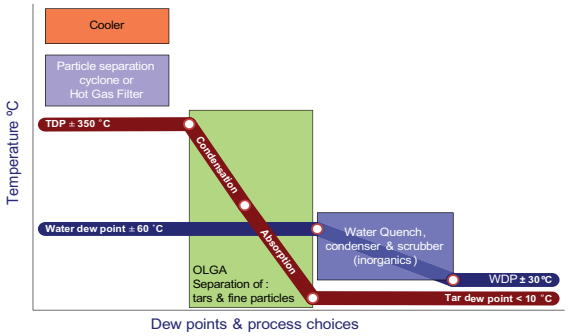
b-08-022

OLGA process philosophy

Product gas contains solids, tars and inorganic impurities. In principle mixing of dust, tar and water must be avoided. In any case it must be avoided to mix tar and water. The philosophy of OLGA is based on dew point control. In the figure below the tar (TDP) and water dew points (WDP) are shown.

Within the OLGA, tars are first condensed in a controlled way without condensing water. In the second section tars are absorbed, lowering the TDP but not the WDP. As a result the TDP decreases to below the WDP, allowing the application of commercially available water based cleaning systems for inorganic components.



Dew points & process choices

The process consists of the following equipment (with typical temperatures between brackets):

- Gas cooler (from 700-900°C to ~380 °C)
- Separation of solids (~380°C)
- Removal of coarse solids by a cyclone and OLGA for fine solid aerosols
- Removal of all solids by a hot gas filter
- OLGA tar removal (inlet ~380°C, outlet ~80°C)
- Safe above water dew point
- Water condenser (~80°C to ~30 °C)
- Water scrubber (~30 °C)

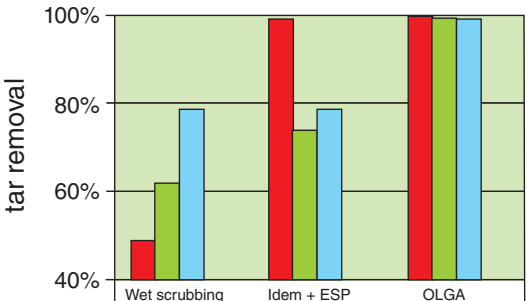
Advantages of OLGA

The OLGA system is a reliable and solid solution for the tar problem. The advantages can be summarized as follows:

- No more tar related problems
- Increased system stability and availability
- Minimization of waste water treatment costs
- No tar waste streams
- Better gas quality compared to a thermal tar cracker
- More reliable and less vulnerable than a catalytic tar cracker
- No poisoned waste water; the problem of tar removal by a water scrubber systems
- Experimental results
- In the figure below a typical experimental measured performance of OLGA is shown.

Experimental results

In the figure below a typical experimental measured performance of OLGA is shown. The performance is compared with conventional gas cleaning based on wet scrubbing and on a wet cleaning with an electrostatic precipitator (ESP).



	Wet scrubbing	Idem + ESP	OLGA
Heavy tars	49%	99%	100%
Light tars	62%	74%	100%
Heterocyclic	79%	79%	99%
Dew point (°C)	180	60	< 20

The most important result is that the tar dew-point of the gas can be decreased to well below 20°C. This means that the gas is applicable without risk of tar condensation and fouling

Commercial information

The OLGA tar removal technology is a patented ECN invention. It was developed by a successful co-operation between ECN & Dahlman, which started in 2001 with lab scale tests.

The activities of Dahlman and ECN are complementary to each other. ECN has the lab and pilot scale facilities, Dahlman has engineering, project management and production facilities. ECN and Dahlman can offer the following support to a gasification project:

- Chemical research
- Lab scale tests
- Pilot scale tests
- Process engineering packages
- Basic design and mechanical engineering
- Detailed engineering
- Turn key delivery & full project management
- Commissioning & start-up on site
- Service & after sales

Further information

ECN
www.ecn.nl

DAHLMAN INDUSTRIAL GROUP
www.dahlman.nl

OLGA tar removal technology website
www.olgatechnology.com