Technology offer: Torwash

There is an abundant amount of biomass available in the world, but the majority of it has properties that make it unsuitable for co-firing in coal plants or for gasification. This concerns wet, fibrous material with a high mineral content. Without pre-treatment, co-firing these types of biomass may lead to many problems in coal-fired power plants (e.g. fouling, slagging, corrosion, etc.) coupled with significant investments to retro-fit existing installations. ECN has developed and successfully tested a hydrothermal treatment, ‘Torwash’ that solves all these issues.

Keywords: bioenergy, biomass pretreatment, biopellet, wet biomass, fibrous biomass, torrefaction, anaerobic digestion, fermentation

Description

• Torwash is a hydrothermal process to convert biomass into biopellets and biogas (methane) or bioelectricity. These pellets have a high caloric value and combustion properties similar to coals such as lignite and browncoal.

New and innovative aspects

• Combination of low temperature pre-wash step and pressurized high temperature 2nd wash step.
• First technology able to convert a wide range of biomass streams in valuable biopellets (c.$100-150/ton). Many of these biomass streams are currently only composted or left as mulch and sometimes even have a negative value.

Main advantages of its use

• Highly efficient due to heat integration, press- dryable biomass and optimal use of biomass by digesting the effluent.
• Optimized conditions for each type of biomass, resulting in high caloric pellets and an effluent that hardly contains indigestible elements.
• Works with different feedstocks allowing flexible operation (e.g. changing feedstock depending on seasonal availability and market conditions).
• Self-supporting installation, suitable for off-grid remote locations, near the source of the biomass.
• Much lower costs of logistics compared to unprocessed biomass. Pellets have a much higher energy density and can be stored outside without any protection from the elements.

Specifications

• The process consists of 5 steps (fig 1.) A shredder is required for most feedstocks (step 1).
• Core of the process is a two-staged hydrothermal treatment (step 2 and 3) to dissolve the minerals that cause difficulties in coal-fired power plants (e.g. Cl, K) in water and to change the fibrous structure of the biomass. Step 2 uses a mild temperature (< 100°C), at step 3 the biomass is pressurized to up to 30 bar and heated up to 230°C. After this, the ‘biopulp’ has become brittle and can easily be press-dried (step 4) after which it can be pelletized (step 5).
• Part of the biomass is washed away (effluent) and digested to create biogas.

▲ Fig. 1: Schematic overview of the Torwash process

▲ Fig. 2: Torwash enables the conversion of many different types of biomass in pellets and biogas or green electricity

• Part of the biogas is combusted to create heat & power for the Torwash process, the rest can be sold as electricity or upgraded to bio-SNG.
• The equipment required for step 1, 4, 5 and the digester/gas engine are all existing technologies, which are readily commercially available.

Potential applications

• Already successfully tested on: roadside grass, miscanthus (“elephant grass”), straw, reed, bamboo, palm oil residues (palm leaves, empty fruit bunches, fruit kernel shell) and coffee pulp.

State of development

• Proof of concept, demonstrated on bench scale

Transaction type and partner profile

• Preferred transaction: license agreement
• ECN is interested to get in contact with:
  – Potential license partners (e.g. entrepreneurs, EPC’s, etc.) willing to invest in the further development (pilot/demo) and capable of successfully commercializing Torwash.
  – Owners of significant biomass streams interested in pilot or demo projects.

Publications and IP

• WO2013162355 (patent pending)
• Torwash Proof of Principle

For more information, please contact: Bart de Vries, Technology Transfer Officer
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