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## Information Package Subcoal<sup>®</sup> technology

In numerous countries around the world, the amount of waste is becoming a growing concern. Typically municipal and (non-hazardous) industrial waste is land filled, however due to land shortage and governmental regulations landfill is becoming increasingly restricted. Other waste handling methods like incineration remain an expensive alternative.

With global rising energy costs there is a general realization of the energy potential of plastics waste that is being buried in the earth. Hence with the rising costs of responsible waste disposal as well as growing energy costs, the caloric value of waste represents an interesting opportunity. With DSM Subcoal<sup>®</sup> technology cellulose/plastic waste can be transformed into high quality fuel.

### History

In the 90's a dedicated environmental research group within DSM Research developed a technology for handling cellulose/plastic waste streams. The invention consists of modifying and purification of waste streams of plastic and cellulose (such as paper and cardboard) into a fuel source.

The process in which a cellulose/plastic waste stream is shredded, dried, purified and pelletized creates high quality fuel pellets. Considerable research has been performed to optimize the pelletizing step which results in pellets with unique properties. Numerous experiments have been performed for the production and combustion of these pellets with varying concentrations of plastic. The Subcoal<sup>®</sup> pellets are among others suitable for very fine grinding in air turbulence mills. The ground powder is suitable for dosing as co-fuel to pulverized coal fired furnaces. The whole technology has been branded as the Subcoal<sup>®</sup> technology.

### Application

The patented process and application technology is suitable for several types and compositions of cellulose/plastic waste streams. The purifying steps allow the fuel to be used in different end applications.

The Subcoal<sup>®</sup> technology covers fluff, pellets or ground powder. Depending on the co-fuel application the Subcoal<sup>®</sup> process can be tuned such to obtain a best fit to the end application. Typically cement and lime kilns can handle either fluff or pellets depending on the design of the furnaces. Subcoal<sup>®</sup> fuel pellets on itself are relatively hard, easy to transport and easy to handle.

Ground powder is especially suitable for high energy-efficient pulverized coal power plants and lime shaft kilns. These high tech facilities have strict fuel specifications so as not to disturb the burning behavior of fuel.

Furthermore ground Subcoal<sup>®</sup> powder is typically dosed in advanced dosing systems. The Subcoal<sup>®</sup> technology is specifically adapted to produce ground powder which satisfies these critical requirements.

### Properties of Pellets/Powder

Subcoal<sup>®</sup> energy pellets are different from the known SRF-like products in that they have a very consistent (high) quality, high caloric value and a high hardness.

The hardness of these pellets makes it easy to grind them. Grinding will take place directly before feeding with powdered coal into high efficient furnaces. High amounts of polyolefins contribute to the high caloric value whereas cellulose is generally considered as biomass. There are some national and local environmental laws and regulations that can provide subsidies on biomass and CO<sub>2</sub> emission and can contribute to the general environmental contribution. The consistent quality of the pellets and/or powder avoids disturbance in the operation of the power plants and lime kilns.

### Proven technology

The concept has been commercially proven in a paper mill in the Netherlands. Due to the use of recycled paper as feedstock, the paper and pulp industry typically must cope with significant waste streams. With the rising waste removal costs, this was an opportunity to apply the DSM Subcoal<sup>®</sup> technology. The paper mill was able to reduce an annual 30,000 tons

waste stream (wet cellulose and plastic waste) into 16,000 tons fuel pellets. These pellets are sold to kilns. Based on the experience in research, chemical installations and safety requirements, DSM was able to design a whole concept which includes pelletizing, shredding, drying, removal of ferro, non-ferro, inerts, etc.

in the proper sequence. Several aspects of this process have been patented.

The technology is fully proven and has run without any technological or operational difficulties and with minimal operator attention since 2000. These fuel pellets are currently marketed as Rofire<sup>®</sup> by SmurfitKappa Roermond BV in the Netherlands.

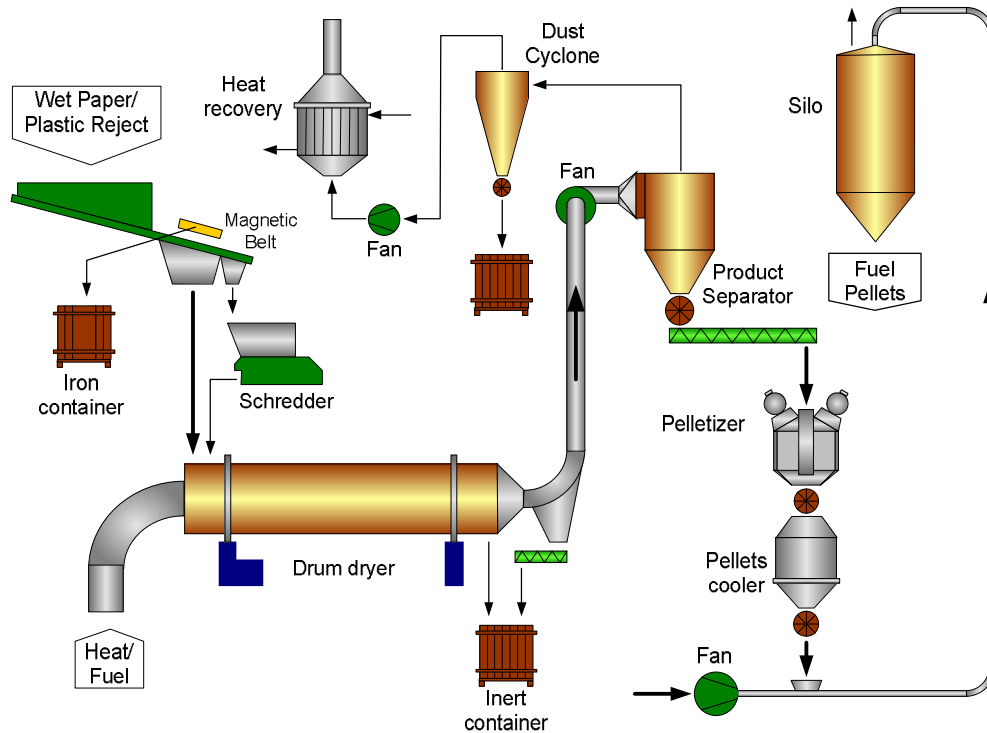


Figure 1: General overview of Subcoal<sup>®</sup> process at SmurfitKappa (the Netherlands)

## Added Value

For waste handlers, paper mills, etc., waste streams can be turned from costs (gate or tipping fee) to positive cash flow. The added value for Subcoal<sup>®</sup> consumers is a substantial lower cost per caloric value and reduction of CO<sub>2</sub> emission. Hence financial benefits can be found on both Subcoal<sup>®</sup> producers and Subcoal<sup>®</sup> consumers.

## Business Development

As owner of the patented Subcoal<sup>®</sup> technology, DSM Licensing and its partner Qlyte Technology can provide the license and technological support for the whole Subcoal<sup>®</sup> technology concept.

For every application the design of the Subcoal<sup>®</sup> technology should be considered and optimized, taking into account feedstock quality and application area. Each furnace has specific design and requirements hence combustion of the secondary fuel always must be tested with dedicated Subcoal<sup>®</sup> fuel product.

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