

Plastic Waste to Liquid Resource

Introduction

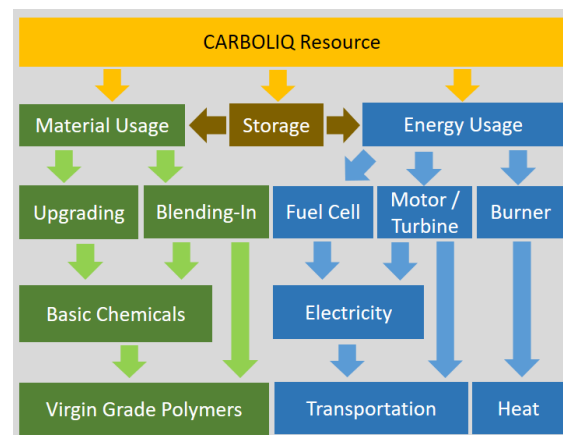
Plastics have become the most relevant materials in today's society. Global plastics production is expected to double in the next 20 years. Besides mechanical recycling being limited, non-recovered plastics cause severe pollution and threaten life. The need for an "after-use plastics economy" has become obvious and starts driving political and business decisions.

It is all about circularizing plastics' resources. Thus, the key to achieving a circular economy is to identify appropriate technologies. Reprocessing plastics without a loss of function and value means changing the paradigms of plastic recycling as we know them. The hydrocarbon resource to be recovered has to have the potential for multiple and high-value use. This ranges from plastics' conversion into high efficient fuels to input oil products for the polymer industries.

carboliq changing paradigms in plastics' recycling

CARBOLIQ GmbH has proven to transform mixed plastic waste into a liquid resource applying a one-stage conversion technology. Its pilot plant of industrial scale, runs in 24/4 mode, is fully licensed according to German law (BImSchG) and is designed to run on standard SRF (Solid Recovered Fuel) derived from Municipal Solid Waste (MSW). The liquid resource has been registered under REACH regulations proving its End-of-Waste-Status and

has successfully been used as a fuel and as a feedstock for a variety of products at BASF's Ludwigshafen plant. Evaluating the fields of application, CARBOLIQ cooperates with international off-take partners.



Fields of Application for CARBOLIQ Resource

The Process

Catalytic Tribochemical Conversion (CTC) is a direct liquefaction process of high-molecular substances which originated from plastic or organics. The process is characterized by the combined application of thermal, catalytic and mechanochemical (tribochemical) mechanisms, applying friction as the only source of energy.

CTC is working at moderate conditions: almost atmospheric pressure and process temperatures below 400 °C. The solid input material is continuously fed to the hot liquid system enriched with a catalyst. Tribo-Chemical Reactors (TCR) mix the slurry and heat it up. Any material evaporating is collected. Any liquid or solid material

recirculates. Residuals are taken out by special conveyors after collected in a sedimentation system. The condensates are dewatered, cooled and collected. Only minor volumes of gases remain. They can be either neutralized by co-burning in a gen-set or by being fed to an exhaust cleaning system.

The Infeeds

CTC is proven to run on SRF which is a mixture of packaging plastics (70%) and celluloses (30%). It has been successfully applied to hard plastics as well as foams. Despite other pyrolysis processes, CTC can handle significant contents of PVC or ABS containing flame retardants as the halogens are bound by neutralists being converted to salts.

The size of the infeed material is limited to 2D: max. 40mm or 3D: max. 5mm. In general, it has to be free of metals, stones, glass, ceramics and porcelain. Humidity should not exceed 18%.

The Products

With CTC being a one-stage process, the product quality depends much on the composition of the infeed material. CARBOLIQ-CLR is the main product derived from standard SRF. It is a storable, multi usable, liquid resource. CARBOLIQ-CLR consists of a mixture of hydrocarbons and is appropriate to be used as an alternative resource for the chemical or petrochemical industry or as combustible / fuel.



CARBOLIC CLR

According to **REACH** regulations, CARBOLIQ CLR is registered as a UVCB substance for PPORD activities. Its EC-No. is 948-684-8. This qualifies **End-of Waste** !

Balances: Mass & Energy

CTC process is most efficient. Proof has been made that from SRF the liquid resource derived counts for 55% of mass. With regards to the energy recovered in CLR, it is 95e% of what was the infeed. With all process energy required amounting to 11e%, the process efficiency results in 84e% overall. This remains unbeaten.

Economics

CARBOLIQ follows a modular concept for its systems engineering.

One module has a capacity of converting 600 – 1.000 kg/h infeed materials into 350



– 500 kg/h of the liquid resource. With four modules being run by one team, the full cost of operation will be < 400 €/t according to current German pricing. Such installation will require a CapEx of 15 Mio.€ for a total capacity of 10.000 t/a.

About

The engineers of RECENSO GmbH developed within CARBOLIQ GmbH the CTC-technology combining all know-how of the ownership and operations experience of the pilot installation in Ennigerloh. CARBOLIQ will serve its worldwide customers with state of the art systems engineering applying CTC to a variety of materials and material mixes as well as appropriate training of operations personnel and maintenance services.