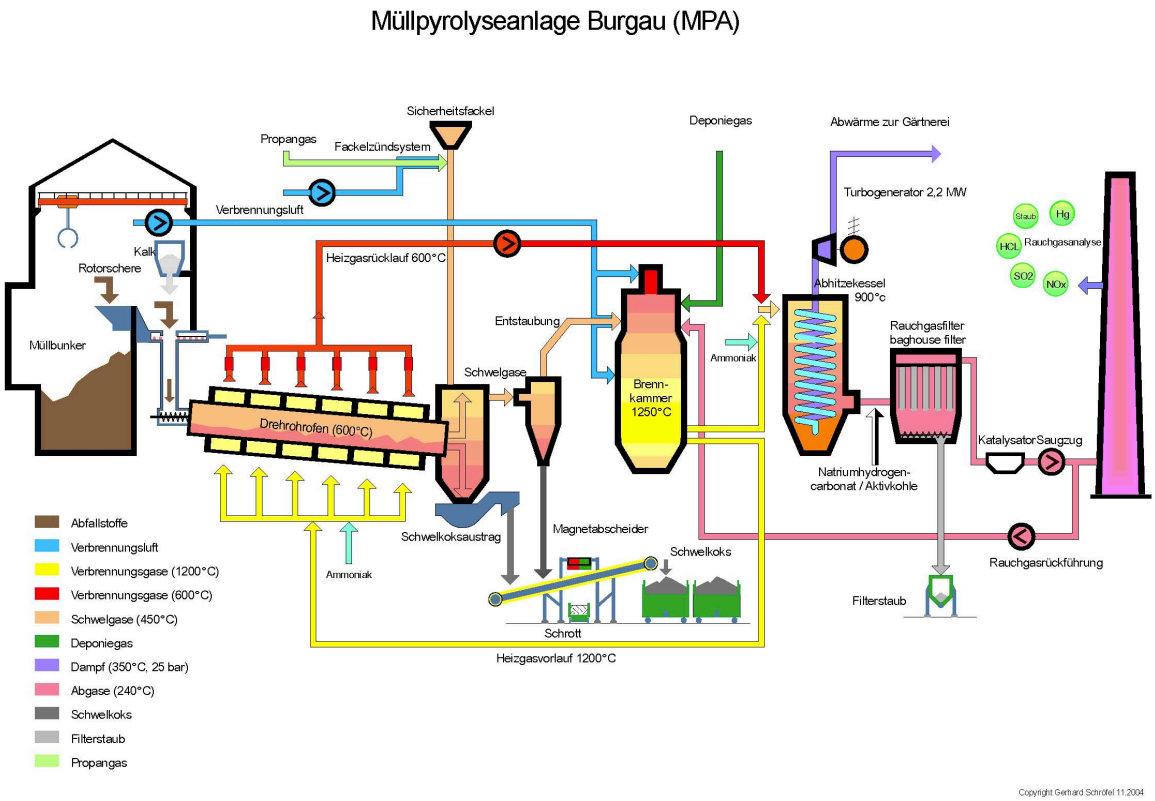
Pyrolysis Facility for Municipal Waste in Bavaria

System configuration

The facility for the treatment of municipal waste based on pyrolysis technology (MPA = Müll-Prolyse-Anlage) has been operating successfully for 2 decades in southern Germany. It's core element are two parallel carbonization drums for thermal treatment of garbage, bulky household-like industrial waste and sewage sludge. The facility had been approved for a nominal throughput of 6 t/h waste (3 t/h per drum), but can effectively handle max. 4 t/h dependent on the calorific value.

A simplified process flow diagram of the MPA is shown in Fig.1.



Firing system

At arrival, all delivered waste is weighed and recorded according to type, quantity and source of waste, and then deposited in the main waste bunker. A crane takes the garbage into a rotary shear for shredding, and then it gets forwarded to the feader bunker. Then it gets funneled through two hoppers with spiral conveyor to the carbonization drums.

Before the discharge-valves screw conveyors add 1.5% calcium hydroxide Ca(OH)2 to the waste for tying acidic pollutants in the smoldering-process (e.g. sulfur dioxide, chlorine, and fluorine-hydrogen). Stuffing screws then forward the waste with added limestone-flour into the carbonization drums.

The waste gets carbonized in the rotating drums of 2.2m diameter and 20m length, which have indirect heating from exhaust gases. This happens without fresh air at temperatures of 470°C to 500°C in about 60 minutes, with the drums turning at 1.5 r.p.m. On the outside of the carbonization drums temperatures reach from 500°C to 680°C.

To prevent the escape of carbonization gas the drums are operated in partial vacuum. At the exit of the drums a seal separates gaseous and solid pyrolysis products. The remaining solid pyrolysis residue (semi-coke) is taken via wet slag remover and belt conveyor system to containers.

Prior to that, a magnetic separator sorts out scrap metal. The semi-coke is then deposited on the central landfill. In the upper part of the drum seal carbonaceous, dusty pyrolysis gases are removed and de-dusted in a cyclone. The cyclone dust is discharged through double pendulum flaps, stored in container troughs and then transported to hazardous waste incinerators.

The clean pyrolysis gas from the drums is burned in a combustion chamber at a temperature of about 1250 °C with an air surplus of 1.3 to 1.5. The combustion air is taken from the waste bunker, which prevents unpleasant odor. In addition, gas from the adjacent landfill gets burned.

The gases from the combustion chamber are used in 2 ways: one part is used for indirect heating of the low-temperature carbonization drum. The exhaust gases there cool down to about 600°C. These, and the remaining part get fed into a heat exchanging device to use the residual energy. The gases get chilled in the waste heat recovery boiler (designed for 12 t/h at 25 bar and 400°C) to 350°C.

A steam turbine with a generator of Pel = 2.2 MW uses this heat energy to produce electric energy. The condensation heat is used to heat a nearby nursery.

Waste gas purification

The emission control system for the combustion-emissions uses a two-stage wastewater-free process. It has a denitrification-system and a suspension bed reactor with baghouse filter separator.

The denitrification-system reduces the nitrogen oxides of the exhaust gas by means of a combination of catalytic and non-catalytic reaction, the SNCR and SCR technology. By two atomizer lances per drum mounted in the fuel gas conduit, and one lance mounted in the exhaust duct upstream of the waste heat boiler, an aqueous urea solution is injected into the hot exhaust gas. The nitrogen oxides and the ammonia from the urea thus reduce to nitrogen and water vapor at ≈900°C.

The adsorbents are separated from the exhaust gases in a 4-part filter at a temperature of ≈ 200°C. The retained dust is collected in a silo and filled in BIG-BAGs.