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Recycling of sewage sludges: pyrolysis.

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Turning waste into carbon-phosphorus-fertiliser

In conventional waste treatment plants nutrients such as carbon and nitrogen are not used as soil fertilisers because they are converted into CO_2 and N_2. If the sludge is burned afterwards, the phosphorus goes by the wayside too. In the future, however, resources are dwindling. The innovative pyrolysis process is saving these nutrients by converting energy-rich sewage sludges into a valuable carbon-phosphorus fertiliser.

Each pyrolysis plant is converting 4.000 tons of dewatered sewage sludge (25% dry matter) into 500 tons of pure biochar. The costs for sewage sludge disposal can be minimized.

This process needs less energy than conventional techniques, reduces CO_2 emissions and was awarded the Austrian Climate Protection Prize 2012 [Österreichischer Klimaschutzpreis 2012].

Technical data

⇒ Capacity: 4.000 t dewatered sewage sludges with 25 % dry matter per year

⇒ Disposal of sewage sludges per plant: up to 50.000 population equivalents (p.e.)

⇒ Production biochar: up to 70 kg/h or 500 t/year (depending on fuel selection)

⇒ Nominal fuel capacity: up to 500 kW per plant

⇒ Maximum operation limits: calorific value > 6 MJ/kg, humidity < 50 %

⇒ Thermal output up to 150 kW exhaust gas heat (depending on fuel selection)

⇒ Power input: approx. 7,5 kWel

⇒ Weight of reactor: approx. 10 t

⇒ Dimensions of reactor: installation in 20-feet-container (approx. 8m x 2,5m x 2,5m)

⇒ Remote data transmission / standardized remote diagnosis and remote maintenance

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Workflow

Section 1, drying: Dewatered sludges of about 25 % dry matter content (DM) are dried to approximately 65 % DM. For this processing step waste heat from the reactor is used. The drying is enclosed, so there is no smell emission or odor nuisance.

Section 2, feeding: The dry fuel is filled by wheel loader into the feed bunker and transported automatically via a scraper floor in the distributor bunker. From there, the material is introduced with a conveyor screw and via a rotary feeder into the reactor.

Section 3, reactor: The dried sewage sludge is conveyed through the reactor with a double screw and heated with exclusion of air to 600 degrees Celsius. The gas formed in the carbonisation process is extracted and fed into the combustion chamber. The material stays in the reactor for 30 minutes, so that hormonal contaminations are completely eliminated. What remains is pure carbon, which is conveyed after passing a water spraying system via a rotary feeder and a discharge screw in the biochar bunker. The resulting gases are burned in the combustion chamber at 1,100 degrees Celsius, and the flue gases are cleaned by a further cyclone. Subsequently, the gases are passed through the jacket of the reactor. Thus, the exhaust stream heats the material that has just been introduced in the reactor. In a subsequent heat exchanger, the residual heat of about 100 to 150 kW is removed and provided for the thermal drying of the sewage sludge.

Section 4, biochar bunker: The temporary storage for biochar, before it is used in soil conditioning or otherwise.

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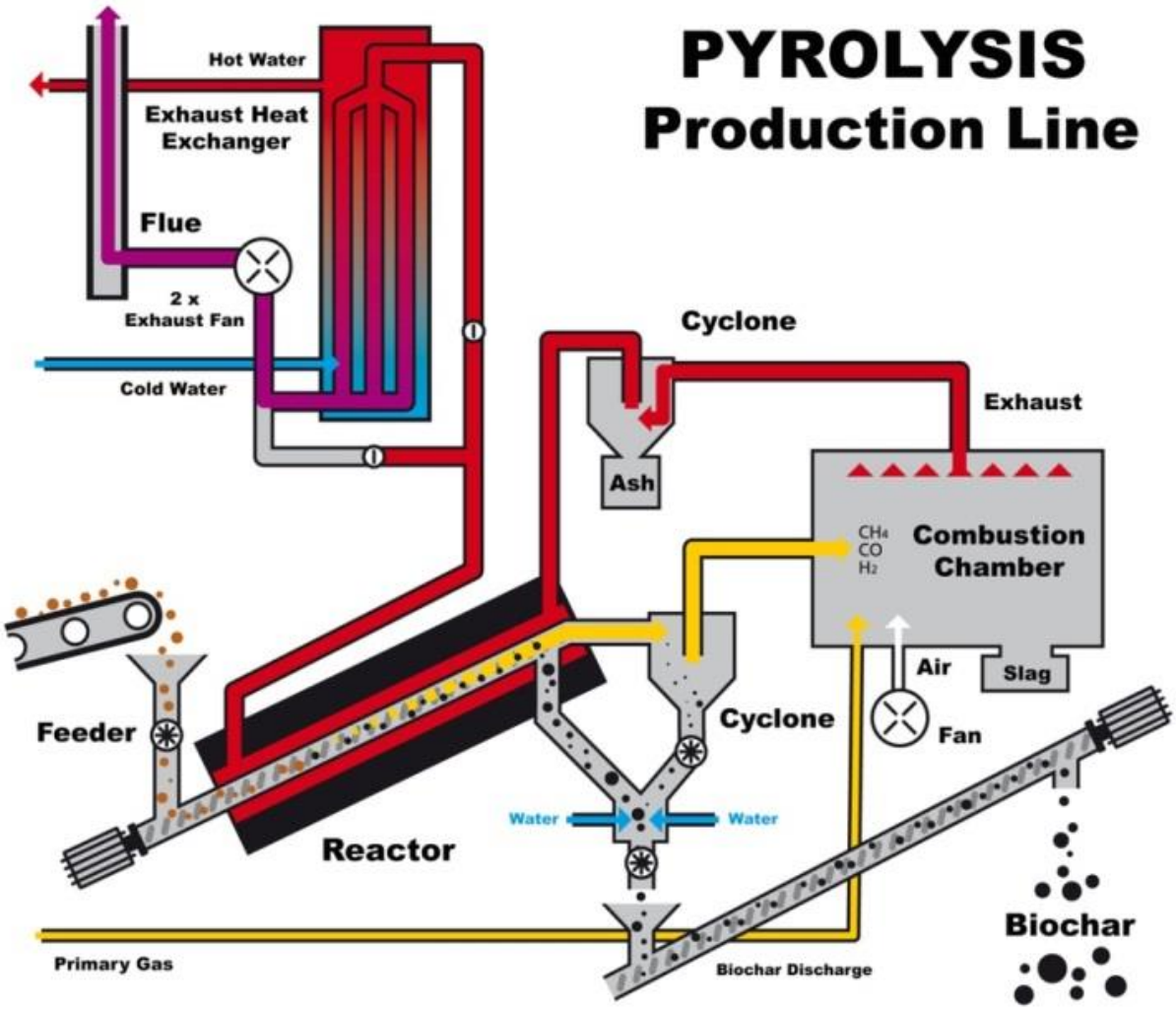
Mode of operation

Drying



Reactor components

⇒ **1: Combustion chamber**, for combustion of carbonisation gases
FLOX©-Burner, Pilot burner

⇒ **2: Ash removal**, for quenching and removal of ash from the process
Screw conveyor to the rotary valve, water cooling system for biochar,
1 x rotary valve for air-tight discharge and burn-back protection

⇒ **3: Fuel distributor**, to introduce the fuel to the chutes at the reactor

⇒ **4: Reactor**, for heating and carbonization of the fuel
2 x rotary valves for anaerobic supply of fuel and burn-back protection

⇒ **5: Exhaust system** with optional heat extraction

⇒ **6: Cabinet for automation**, control system Siemens SPS7-300