

- |                           |                             |  |
|---------------------------|-----------------------------|--|
| 1 Sewage sludge inlet     | 5 Cyclone                   | 9 Flue gas to WtE boiler                         |
| 2 Rotary kiln             | 6 Ash outlet                | 10 Recirculated flue gas for temperature control |
| 3 Mill                    | 7 Flue gas from WtE boiler  |  |
| 4 Post-combustion chamber | 8 Flue gas from rotary kiln |  |

Reference plant: 2 x 40.000 tOS/a (approx. 25% DS) => approx. 2 x 10.000 tDM/a

# MONO-COMBUSTION OF SEWAGE SLUDGE USING A ROTARY KILN SYSTEM

## INTEGRATED SOLUTION FOR A WASTE-TO-ENERGY PLANT

## MONO-COMBUSTION OF SEWAGE SLUDGE USING A ROTARY KILN SYSTEM

Within the business area Waste-to-Energy, Mitsubishi Power Europe GmbH is providing solutions for the utilisation of sewage sludge. In contrast to building a dedicated mono-combustion plant with fluidised bed technology, significant reduced approval times and half of investment are expected.

Mitsubishi Power Europe has developed a sophisticated concept that utilises a rotary kiln system and a post-combustion process. Alongside the rotary kiln, the core technology consists of a combination of a cyclone, mill and post-combustion chamber. With this system a TOC (Total Organic Content) value of less than 3% can be achieved with a high throughput of sewage sludge.

The flue gas required for operating the rotary kiln and for the post-combustion of the ash is extracted from the existing boiler and flows initially into the post-combustion chamber. The extracted ash from the rotary kiln is grinded in the mill. The burnout of the ash is assured by injection of the ash into the post-combustion chamber.

After this thermal process, the mixture of flue gas and burnt ash flows into a cyclone, where the ash is finally separated from the flue gas stream. While the flue gas flows into the rotary kiln for the combustion, the ash is transported by a water-cooled screw conveyor into ash silos for the purpose of phosphorus recovery.

The flue gas coming from the post-combustion flows counter-current through the rotary kiln. The flue gas serves as a carrier for heat and oxygen and ensures the process of drying, gasification and burnout of sewage sludge.

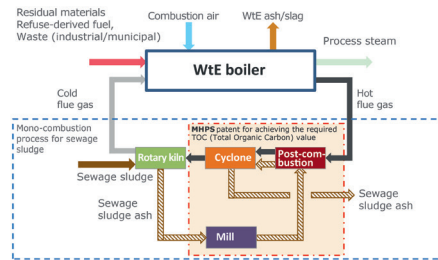
The resulting process gas flows through the ducting back into the existing boiler furnace. The rotary kiln operates under sub-stoichiometric conditions as a gasifier.

The rotary kiln is equipped with appropriate inlets and lifting devices to loosen the sewage sludge in order to increase the required area of the active drying and burnout surface.

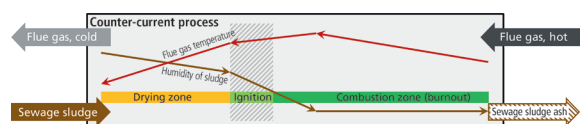
Both the process described above and installation of modified blades for a rotating process gas flow in the combustion zone of the rotary kiln contribute to reducing the TOC even further. CFD calculation and drop tube tests of ash burnout already indicate promising results for achieving a lower TOC.

The post-combustion process described in this document has been registered for patent by Mitsubishi Power Europe and is therefore protected by law.

### WtE PROCESS WITH INTEGRATED MONO-COMBUSTION OF SEWAGE SLUDGE

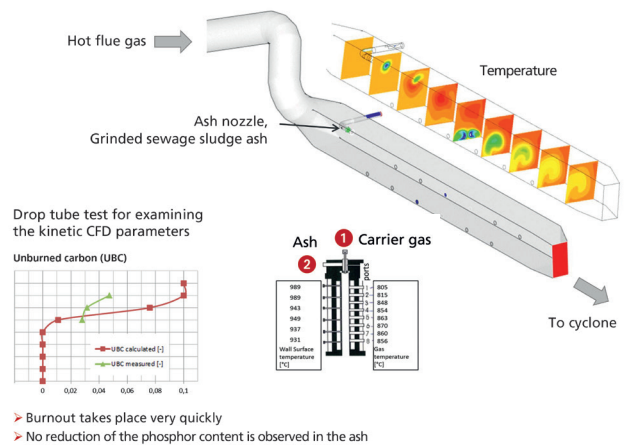


### COMBUSTION PROCESS IN ROTARY KILN



### POST-COMBUSTION PROCESS FOR ACHIEVING LOW TOC VALUES

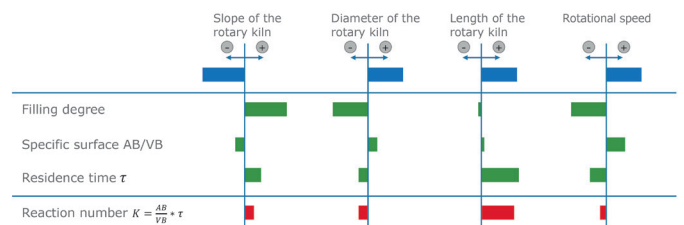
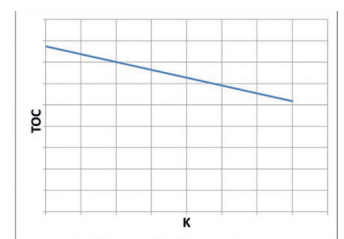
CFD design of the post-combustion chamber



### MEASURES FOR REDUCING TOC

**Qualitative influence** of various parameters on reaction number (K) or TOC (at constant ash mass flow)

- Slope of the rotary kiln
- Diameter of the rotary kiln
- Length of the rotary kiln
- Rotational speed



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