RASCHKA

NEWSLETTER

October 2015

Sludge Incineration Technology

Sludge typically originates from:

- Industrial and communal waste water treatment
- Water sedimentation tank/concentration pound
- Pound/tank bottom sludge
- Soil polluted by chemicals or oil

Sludge generally contains harmful organic substances (chemicals, bacteria, viruses, parasites etc.) and heavy metals.

Sludge is waste that must be treated in order to destroy, to remove and to dispose the harmful components and to avoid impact to nature and mankind.

On the other hand sludge contains energy and valuable raw materials (e.g. phosphorus) that must be recovered and utilized

Sludge typically has a high water content (up to 99 %). This means to treat a huge volume.

In the first step the sludge must be dewatered to reduce the volume for the further treatment. The mechanical dewatering of the sludge usually is effected by means of centrifuges, chamber filter or belt presses. The water content of mechanically dewatered sludge can be reduced to approx. 65 %.

The further state-of- the- art sludge treatment is the sludge incineration in a fluidized bed incinerator: the sludge water is evaporated and super-heated, the organic substances/ pollutants are completely combusted, the inorganic pollutants are glowed. The energy set free in the incineration process is recovered and utilized for the process itself, for power generation and heating purposes. The flue gas is cleaned from ash, acidic components and heavy metals by means of a high-tech flue gas treatment system ensuring to meet governmental requirements. The ash precipitated can be landfilled and utilized for phosphorous recovery, the residues from the flue gas cleaning process can be disposed in dedicated landfill areas in a controlled and environmentally compliant way.

Sludge treatment requires a **save** and **effective treatment method** based on **proven technology**!

Typical Sludge Treatment Methods

Currently, there are 4 typical methods of sludge disposal:

1. Landfill and agricultural use

Landfill after mechanical dewatering is a popular way because of cost reason. Sludge landfill and spreading on land have been the preferred “treatment” for a long time. However, the water content of mechanically dewatered sludge is much too high and exceeds the regular landfill requirement.

Landfill and spreading on land mean severe risks to environment and mankind (leaching of contaminated water, risk of polluting the groundwater, the soil and the agricultural products, concentration of pollutants and heavy metals).

In Europe these kinds of disposal are strictly restricted/ forbidden.

2. Compost Generation

Compost generation used to be a popular way for sludge disposal. The basic theory is to use aerobic microorganism to decompose kinds of organic oxides in sludge, turning it into humus which can easily be absorbed by plants and used as fertilizer.

Composted sludge still contains organics, pollutants and heavy metals and means risks of pollution (soil, groundwater, agricultural products) and of concentration of pollutants and heavy metals. Thus compost generation is no option for save and environmentally friendly final sludge treatment and disposal.

3. Drying

Sludge drying technology is using heat to evaporate most of the sludge water to obtain a dry mass content of up to ~ 90 %. Additionally the sludge is sterilized.

Drying requires a lot of energy, is complicated, requires high investment and operational cost. A further expensive treatment of the evaporated malodorous sludge water is necessary. The dried sludge is not stable, the organic matter and pollutants are not destroyed, landfill is not permitted (high organic content). Drying is no option for final sludge treatment and disposal.

4. Incineration

The solution for save and environmentally friendly final sludge treatment and disposal is sludge incineration. It serves reliably for the evaporation of the moisture and the destruction of the organic matter and pathogens.

The sludge incineration achieves a volume reduction over 90%. Sludge incineration is the most efficient method for volume reduction in a stable and safe way. Mechanically dewatered sludge can directly be fed into the incinerator or alternatively it will be dried before incineration.

But not all incineration processes are suitable for sludge incineration – only fluidized bed incineration is generally accepted as best available techniques (BAT) for sludge incineration.

The fluidized bed incineration process we recommend allows the auto-thermal sludge incineration without additional fuel. The energy set free in the process is recovered and can be utilized for power production, too. The flue gas is cleaned according to the relevant regulations, the residues are ready for utilization resp. disposal.

Raschka Fluidized Bed Incinerator

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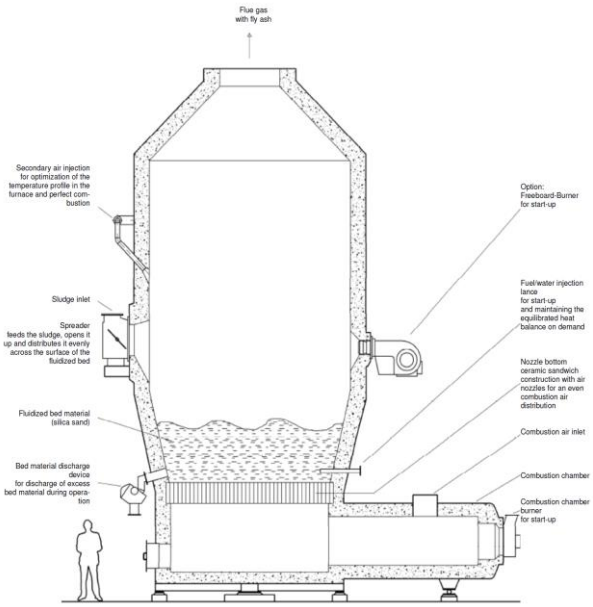
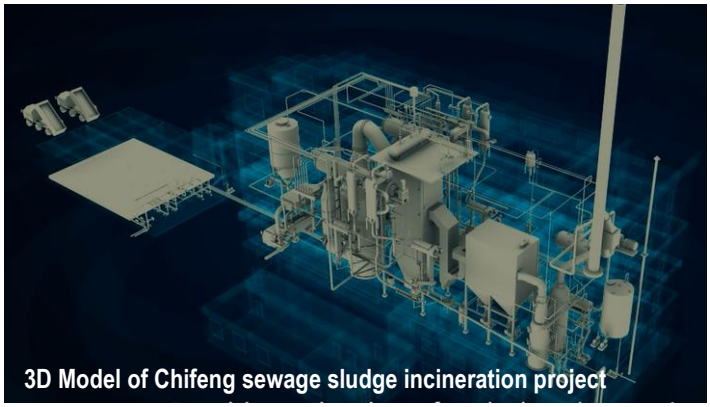
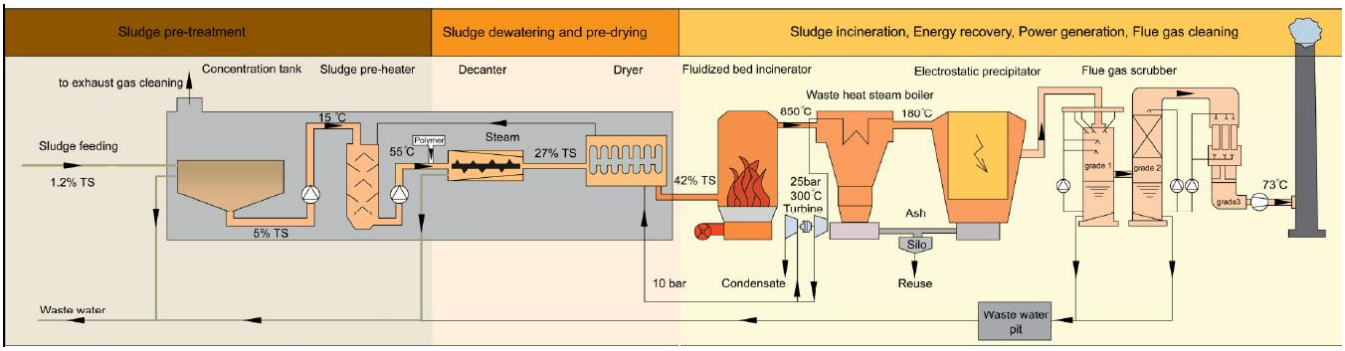


RASCHKA Fluidized Bed Incineration is the best choice: Incineration at 850-870 °C ensuring a complete combustion, high incineration efficiency, long flue gas retention time, even temperature distribution, excellent destruction of harmful components, economic operation, low maintenance and long life cycle!



Fluidized Bed Incineration Process Description

Sludge incinerator system includes: sludge feeding, sludge pre-treatment, fluidized bed incinerator, waste heat steam boiler, power generation, flue gas cleaning

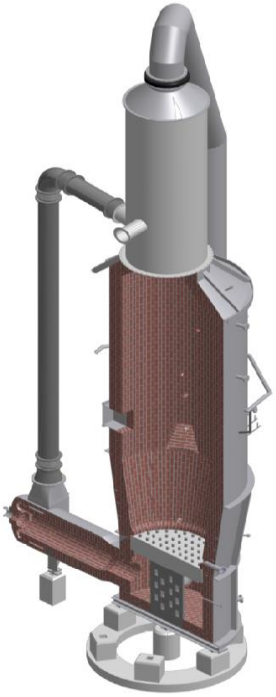


Sludge feeding system----feeding the sludge

Due to the high water content (sludge from wastewater treatment plant: ~98 %) a pump is used to feed the sludge to a centrifuge for dewatering, after that, the sludge has a water content of ~75 % and can now be conveyed by screw or belt conveyors.

Sludge pre-treatment system----to reduce the water content

Water content is the key element driving operational cost: higher water content means lower heating value to the result that the incineration process needs more energy and this obviously drives operational cost up. Usual sludge dewatering devices are belt filter presses, chamber filter presses and preferably centrifuges. The water content remains at about 80%-75% after mechanical dewatering, the sludge can be fed into the fluidized bed incinerator directly. To achieve an incineration process without additional fuel the sludge is dryed to achieve a heating value necessary for this process. The heating energy for the pre-drying comes from recovered energy from the incineration process. This saves a great deal of operational cost.



RASCHKA Fluidized Bed Incinerator----the key component

The fluidized bed incinerator has a steel casing with an inner refractory lining and an outer thermal insulation. The main sections are the lower part with the windbox, the nozzle bottom and fluidized bed area and the cylindrical upper part with the freeboard area. The nozzle bottom is a ceramic sandwich construction equipped with air nozzles made of heat resistant cast steel.

The combustion air is blown by the combustion air blower into the combustion chamber that is connected to the windbox. From there the combustion air comes into the windbox below the nozzle bottom. Then the combustion air flows through the air nozzles in the nozzle bottom upwards and fluidizes the sand-layer above the nozzle bottom evenly. During heating up of the incinerator the combustion air is heated up in the combustion chamber by means of the combustion chamber burner. The heating up is supported by special fuel injection lances mounted in the fluidized bed area. Then the sewage sludge is conveyed evenly and exactly dosed to the RASCHKA-spreader. The spreader open up and feed the sludge evenly distributed across the fluidized bed. In the furnace the moisture of the sludge is evaporated and superheated, the organic substance combusts and the inorganic dry substance glows out. As soon as stable incineration conditions are achieved, the start-up burner and the lances are switched off and an auto-thermal incineration process continues.

The freeboard area above the fluidized bed serves as post-combustion zone with long retention times of the flue gas and fly ash particles. Secondary air can be injected for an optimization of the process- an efficient and complete combustion. The outstanding layout and design of the RASCHKA fluidized bed incinerators offer very low NOx values (remarkably below the European/German emission limits) without any NOx reduction systems

If the sludge is defined as dangerous waste to be incinerated at 1'100 °C a secondary combustion chamber can be installed.

Waste heat steam boiler, power generation----to recover and utilizing the heat energy coming from the incineration

The waste heat steam boiler recovers the energy from the hot flue gas leaving the fluidized bed incinerator and produces steam. The special designed boiler is designed to deal with highly dust loaded flue gas. The steam is utilized the process itself, for power generation by means of a steam turbine with generator and for heating purposes.

Flue gas treatment system---- to keep the emission limits reliably

The treatment system includes a dust filter and a flue gas cleaning system (wet, effluent free or dry systems available) to remove acidic components, heavy metals and other pollutants.

Tailor-made solutions provided by RASCHKA ENGINEERING

- Improved mechanical sludge dewatering: thin sludge pre-heating, optimized polymer mixing and feeding, high performance centrifuges in order to reduce the water content to < 72 %
- Thermal sludge pre-drying: steam or thermal oil heated sludge dryers to obtain a sludge heating value sufficient for an auto-thermal incineration process without additional valuable fossil fuel
- Compact plant design with small footprint: short conveying distances, effective and reliable conveyors
- Advanced incineration process: fluidized bed incinerator with special and proven design ensuring outstanding incineration results
- Efficient energy recovery and utilization: waste heat steam boilers, designed for dust loaded flue gas, high performance steam turbines
- Reliable flue gas cleaning: fly ash/dust precipitation, removal of pollutants by dry, effluent free or wet systems, keeping the emission limits reliably
- Reliability, effectiveness, low maintenance and operational costs: experience, first class proven technology and components, advanced plant control systems
- Individual, tailor-made BAT solutions meeting exactly the client's requirements, including initial research, process design, EPC.

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