P-REX

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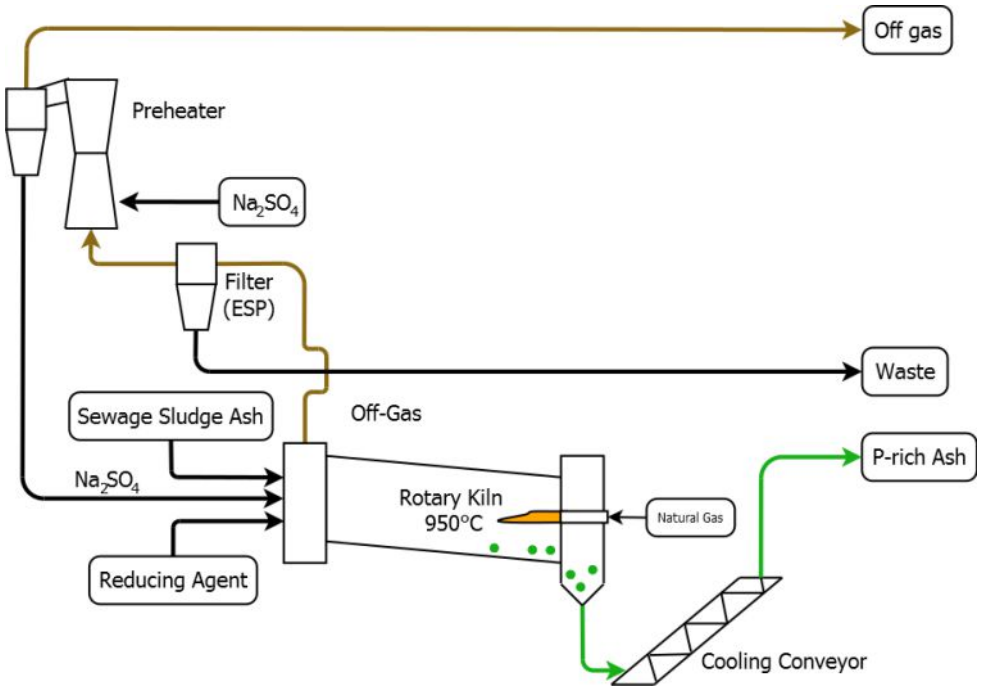
Ashdec®

Thermo-chemical ash treatment

Short description

The ASH DEC process thermochemically treats sewage sludge ash (SSA) in a rotary kiln and has been jointly developed by Outotec and BAM Federal Institute for Materials Research and Testing. The phosphate phases present in SSA are transformed into bio-available $NaCaPO_4$ by reaction with Na_2SO_4 at 900 - 1000 °C with a minimum retention time of 20 min. Dry sewage sludge is used as a reducing agent in this process. Volatile heavy metals (As, Cd, Hg, Pb, Zn) evaporate and are removed via gas phase. The hot kiln off gas could be used to heat ash, Na_2SO_4 and kiln air for energetic process optimization. An alternative ASH DEC process is the treatment with $MgCl_2$. In this process heavy metals are removed via gas phase in form of the respective chlorides and oxichlorides and phosphorus is transformed into calcium-magnesium phosphates. Heavy metal removal via the chloride pathway is generally superior compared to the process under reducing conditions, but the bioavailability of the output material of the $MgCl_2$-process is limited to acidic soils (pH=<7).

Process scheme



This project has received funding from the European Union's Seventh Framework Programme for Research, Technological Development and Demonstration under the Grant Agreement no. 308645.

General Data

Type of Process	thermochemical
Type of Plant	rotary kiln
Input Material	sewage sludge ash
Output Material	calcined ash with $CaNaPO_4$ phase
P-concentration	15 - 25 % P_2O_5
P recovery performance[1]	98°% of P in sewage sludge ash

Supply

Average total electricity demand[1]	0.8 - 0.9 [kWh/kg $P_{recovered}$]
Average total natural gas demand[1]	5.2 [kWh/kg $P_{recovered}$] (stand alone) 3.5 [kWh/kg $P_{recovered}$] (integrated)
Average chemical demand[1] (as 100% concentrate)	3.3 [kg Na_2SO_4/kg $P_{recovered}$] 1.3 [kg dried sludge/kg $P_{recovered}$] 0.1 [kg $Ca(OH)_2$/kg $P_{recovered}$] 0.1 [kg NaOH/kg $P_{recovered}$]

Advantages

- Process applicable for ashes of WWTP with enhanced biological and chemical P removal
- Production of highly plant available phosphate ($CaNaPO_4$) with Na_2SO_4 addition
- Removal of As and heavy metals (Cd, Hg, Pb, Tl, Zn) in ash
- Low amounts of waste for disposal (2 - 3 % of ash)

Remarks

- ASH DEC reactor requires natural gas as fuel
- Energy consumption based on simulation
- Integration of ASH DEC into existing mono-incineration decreases demand for natural gas (transfer of hot ash into rotary kiln) and for electricity because of sharing off-gas cleaning
- Successful demonstration trial with new process based on Na_2SO_4
- The process is particularly cost efficient for P-rich and Si-poor ash

Patents and Licenses

Patent held by	Outotec
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References

Pilot plant for ASH DEC

with $MgCl_2$ process 2008-2010

Two weeks demonstration and production (2 t) trial for ASH DEC

with Na_2SO_4 process in cooperation with external company IBU-tec advanced materials AG, Weimar/Germany in 2014.

[1]1Process data related to reference sludge line defined in P-REX (ash of wastewater treatment plant for 1 Mio inhabitant equivalents), ash composition (% DM): 10.7% P, 5% Fe (EBPR ash) or 15% Fe (ChemP ash). More information on modelling can be found in fact sheet "reference model" and P-REX LCA report.

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