



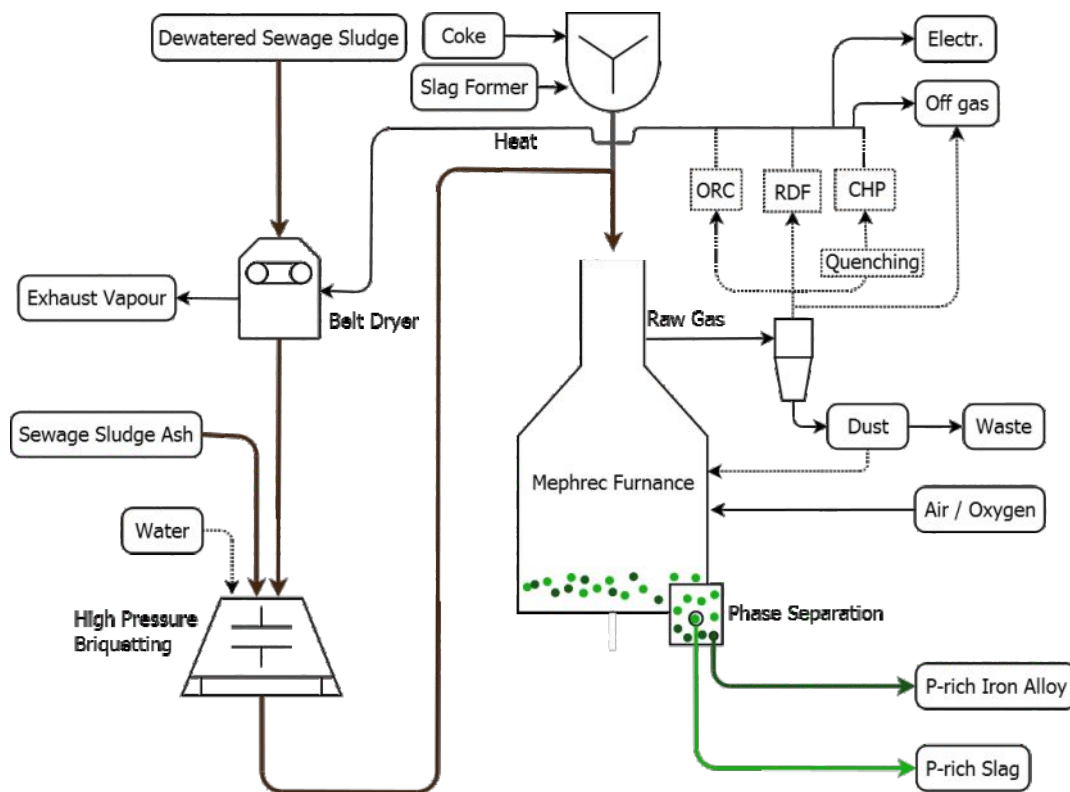
Mephrec[®] Metallurgical sludge or ash treatment

Short description

The Mephrec process was developed by the German company Ingitec for recovery of phosphorus from sewage sludge and/or ash. Dewatered sewage sludge (>25 % dry matter (DM)) is dried to 80 % DM and pressed into briquettes. The briquettes of sludge and/or ash are thermally treated (gasification) in a shaft furnace at temperatures above 1450 °C. Heavy metal compounds are reduced under these conditions into their elemental form. Volatile metals (Cd, Hg, Pb, Zn) are evaporated and separated via gas phase whereas non-volatile heavy metals are separated from the

slag in form of a liquid metal phase. The phosphates present in sewage sludge are transformed into silico-phosphates (comparable to “thomas phosphate”). The Mephrec process with sludge as raw material also produces electricity and heat with the highly calorific raw gas. The raw gas can be directly injected into an Organic Rankine Cycle (ORC) process or municipal waste incineration plant, or refined in multiple steps to feed a combined heat and power (CHP) plant.

Process scheme



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General Data

Type of process	reducing shaft melting gasification
Type of plant	coke fired oxygen shaft melting gasifier
Input material	sewage sludge and/or ash
Output material	slag
P concentration in slag	10 - 25 % P ₂ O ₅
P recovery performance in slag ¹	81% of P in input sludge/ash
P in iron alloy ¹	> 5 % of P in input sludge/ash
Energy recovery potential in off-gas ¹	55 kWh/kg P _{recovered} (for sludge as input)

Supply

Estimated electricity demand (ash) ¹	1.2 [kWh/kg P _{recovered}]
Estimated electricity demand (sludge) ¹	12 [kWh/kg P _{recovered}] (incl. drying)
Estimated heat demand (sludge) ¹	68 [kWh/kg P _{recovered}] (for drying)
Estimated chemical demand ¹ (100% concentration)	2.3 - 2.7 [kg coke/kg P _{recovered}] 0.4 - 0.8 [kg O ₂ /kg P _{recovered}] 1.3 [kg dolomite/kg P _{recovered}] 0.1 [kg Ca(OH) ₂ /kg P _{recovered}]

Advantages

- P recovery process for sludge and/or ash as input material
- Process applicable for P rich waste, sludge and ashes of WWTP with enhanced biological or chemical P removal
- Energetic and material recycling in single process step (for sludge as input)
- Main output is slag (enriched with P, depleted in heavy metals)
- By-product: iron alloy with P content
- By-product (sludge as input): raw gas with high calorific value

Remarks

- Pilot plant in Nuremberg in planning, production will start in 2015
- Validation of process parameters intended in pilot plant
- Slag has a P solubility in citric acid comparable to “thomas phosphate”

Patents and Licenses

Patent held by	ingitec
Contact	Joachim Mallon
Phone	+49 341 453260
Mail	info@ingitec.de
Website	www.ingitec.de

References

Test trials

with a metallurgical shaft furnace (modified small cupola) at Bergakademie Freiberg (2008)

¹Process data related to reference sludge line defined in P-REX (dewatered sludge or ash of wastewater treatment plant for 1 Mio inhabitant equivalents), sludge composition (25% DM): 54% VS, 4% P, 7% Fe in DM, ash composition (% DM): 9.5% P, 15% Fe. More information on modelling can be found in fact sheet “reference model” and P-REX LCA report.