

# OUTOTEC MODULAR ENERGY AND PHOSPHORUS RECOVERY PROCESSES

**LUDWIG HERMANN**

SENIOR CONSULTANT ENERGY, OUTOTEC, ludwig.hermann@outotec.com, www.outotec.com

## INCINERATION OR GASIFICATION OF PHOSPHORUS RICH WASTE FLOWS



Incineration or gasification is the key to phosphorus recovery with high efficacy = effectiveness + efficiency. Outotec's fluidized bed incineration or gasification techniques generate energy and produce a renewable phosphate concentrate from all phosphorus rich feedstocks.

### Feedstock:

Municipal sewage sludge, farmyard manure solids, animal by-products

### Products:

- Ash borne phosphate concentrate, containing 20-35% P<sub>2</sub>O<sub>5</sub>, similar to phosphate concentrates from rock
- Heat and energy carriers (steam, electricity or syngas)

Downstream processing to high value, pollutant free fertilizers depends on the type of original feedstock.

- Low impurity, ash borne concentrates - for instance animal by-products or chicken litter ashes - are recommended for wet chemical processing by phosphate fertilizer industries
- High impurity, ash borne concentrates - for instance sewage sludge or pig manure ashes - are recommended for thermo-chemical processing by the ASH DEC process

### ROCK PHOSPHATE & DIFFERENT BIOMASS ASH ANALYSES

Substance	Khouribga rock MA	D <sup>11</sup> Animal by-products	NL <sup>21</sup> Poultry manure	NL Pig manure 1	NL Pig manure 2	NL WWTP Sludge
P <sub>2</sub> O <sub>5</sub> %	32.97	32.50	22.71	23.60	22.00	21.30
CaO %	51.34	44.10	37.19	17.90	16.80	15.70
SiO <sub>2</sub> %	2.35	1.80	3.19	15.70	10.90	21.60
Al <sub>2</sub> O <sub>3</sub> %	0.40	1.10	0.79	1.70	1.00	10.80
Fe <sub>2</sub> O <sub>3</sub> %	0.20	1.00	1.05	2.10	11.90	16.30
MgO %	0.30	3.00	6.67	13.10	11.00	2.90
Na <sub>2</sub> O %	0.80	7.90	3.59	1.60	1.80	1.00
K <sub>2</sub> O %	0.10	2.90	17.17	6.80	7.70	1.00
SO <sub>3</sub> %	1.70	4.30	6.71	6.10	11.70	5.00
Cd mg/kg P <sub>2</sub> O <sub>5</sub>	51.60	0.92	21.09	10.17	12.72	13.76
Pb mg/kg P <sub>2</sub> O <sub>5</sub>	9.10	26.77	475.56	33.89	36.36	943.67
Zn mg/kg P <sub>2</sub> O <sub>5</sub>	700.00	1'415.38	12'091.59	31'355.93	25'000.00	10'239.43

<sup>11</sup>Kley, G., 2004 <sup>21</sup><http://www.biodat.eu/>

## ASH DEC

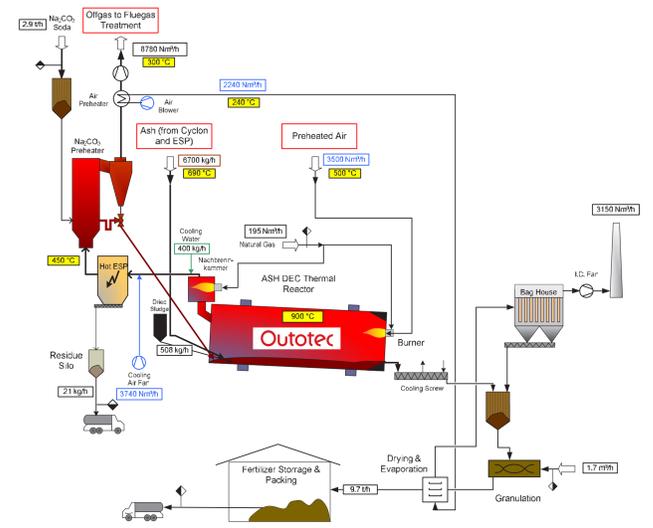
### Feedstock:

Ash, gasification residues, biochar

### Product:

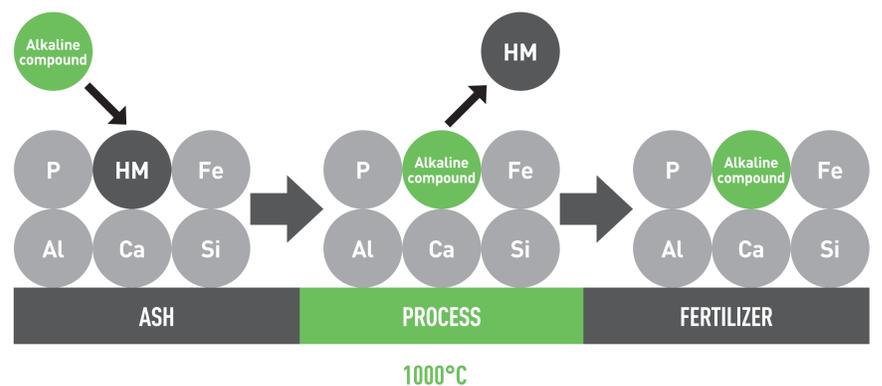
Phosphate fertilizer with Mg, S and trace nutrients and high bio-availability

Outotec ASH DEC technology is a thermo-chemical process which eliminates heavy metals from ash while making nutrients plant available.

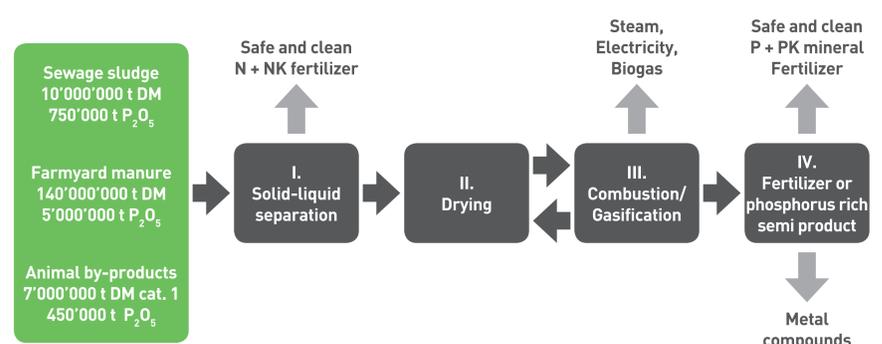


### How it works:

Ash and alkaline additives are mixed and heated to 800-1000°C in a reactor, where phosphate and additive compounds are cracked to form bio-available phosphate compounds. Pollutants (heavy metals = HM) are forced to the gaseous state to be removed by the air pollution control system.



Best economic results and lowest environmental footprint are achieved by vertically integrating the fertilizer manufacturing plant to the sludge or manure incinerator. Integrated plants may share a number of compounds saving CAPEX and may save repeated heating cycles saving energy and OPEX.



POTENTIAL TECHNICAL RENEWABLE ENERGY YIELD OF EU27 MANURE:  
583 TWH (2'100'000 TJ) = ~3% OF TOTAL ENERGY CONSUMPTION