TerraNova® Ultra
Innovative Sludge Treatment

- economical
- environmentally friendly
- energy efficient
- proven and awarded technology

Carbonization of sewage sludge
Phosphorous recovery

TerraNova® Ultra for middle sized and large sewage treatment plants
Sludge recycling instead of expensive disposal - Recover energy and nutrients

The safe disposal of sewage sludge - a residue of the wastewater treatment process - is a pressing global challenge that bears constantly rising cost due to increasing environmental standards.

At the same time sewage sludge offers a great potential for green energy production and recovery of nutrients like valuable Phosphorous for fertilization.

Through the TerraNova® Ultra technology sewage sludge is utilized in an innovative way - for climate and environmental protection.

From sewage sludge to climate friendly coal - the process

Through the TerraNova® Ultra process sewage sludge is carbonized into a coal - similar to lignite coal. But unlike that the "sewage coal" is climate friendly since it is produced from regenerative sewage sludge.

Dewatered sewage sludge (1) is pre-heated by excess process heat in the heat exchanger (2). In a pressure - cooker like vessel (3) a catalyst is being added and coal slurry is generated within a few hours.

In an outlet heat exchanger (4) the coal slurry is cooled down and the water is extracted in a filter press (5) to result in coal with 65% or 90% dry matter (6) that can be used as CO2 neutral solid fuel. The extracted water (7) contains valuable nutrients like Phosphorous and Nitrogen that can be recovered as fertilizer. The volume for disposal was reduced to less than a quarter.

The German chemist Bergius was awarded with the Nobel price for the basic research in this field beginning the 20st century.
The advantage of TerraNova® Ultra

In comparison to other sewage sludge technologies the sludge water, which represents by far the largest component of sewage sludge, is not evaporated but mechanically extracted in a very energy efficient way. It produces additional biogas in digestion plants and therefore increases the electrical power generation, so the processes complete energy demand can be covered without external supply. It also allows for recovery of Phosphorous, which will be essential in the future in light of diminishing resources and further growing demand by the agricultural sector. Since no steam is used for the heat supply the process does not require continuous supervision.

Phosphorous recovery by TerraNova® Ultra

By addition of acid to the coal slurry within the process the largest part of the sludge Phosphorous is leached into the liquid phase. Heavy metals remain in the solid phase due to its strong bonding force.

By means of a simple fixation to Calcium Silicate Hydrate (CSH), a side product from the construction industry, the Phosphorous is bound and extracted in a filter press.

All different types of sewage sludge are suited for treatment by TerraNova® Ultra, independently of the precipitant being used on the sewage treatment plant (iron- or aluminum based precipitant, biological precipitation). The simplicity of the process and the low cost reagents allow for an economic operation.

The remaining, Phosphorous depleted coal, can be used for energy production in co-firing plants or cement kilns.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phosphorous $P_2O_5$</td>
<td>&gt; 16 %</td>
</tr>
<tr>
<td>Plant availability (citric acid)</td>
<td>&gt; 75%</td>
</tr>
<tr>
<td>Total Nitrogen N</td>
<td>1-2 %</td>
</tr>
<tr>
<td>Potassium $K_2O$</td>
<td>&lt; 1 %</td>
</tr>
<tr>
<td>Magnesium $MgO$</td>
<td>&lt; 1 %</td>
</tr>
<tr>
<td>Lead</td>
<td>&lt; 10 mg/kg</td>
</tr>
<tr>
<td>Cadmium</td>
<td>&lt; 0.5 mg/kg</td>
</tr>
<tr>
<td>Chrome</td>
<td>&lt; 50 mg/kg</td>
</tr>
<tr>
<td>Copper</td>
<td>&lt; 20 mg/kg</td>
</tr>
<tr>
<td>Nickel</td>
<td>&lt; 10 mg/kg</td>
</tr>
<tr>
<td>Mercury</td>
<td>&lt; detection limit</td>
</tr>
<tr>
<td>Zinc</td>
<td>&lt; 200 mg/kg</td>
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<tr>
<td>P recovery rate</td>
<td>60-80 %</td>
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</tbody>
</table>

TerraNova® Ultra Recycling Phosphorous

(Values based on dry matter)

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**TerraNova® Ultra**

- Reduction of disposal volume by 75%
- 80% less energy demand than drying
- 15% higher biogas yield
- Phosphorous recovery
- Unattended operation, no 24/7 supervision required

*(typical values)*

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