

**No-Residue Treatment and Disposal
of mixed, unsegregated
Municipal Solid Waste**

**“CombiTec” Combined Anaerobic Digestion
and Gasification Technology
with
Conversion into Electricity**

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CombiTec – the valuable Alternative

- Great variety of mixed input material (organics, plastics, wood, textiles, manure)
- Treatment of wet, dirty, contaminated waste
- Use of mixed unsegregated municipal solid waste (MSW) without any pre-sorting.
- Apart from electricity generation of high quality compost fertiliser
- Conversion approx. 95% of MSW into energy, accordingly the problem of disposal of residues practically does not exist.
- Practically no residues, except a small mineral fraction (stones, broken glass, ceramics, etc.)
- Safe elimination of all toxic components such as halogens and heavy metals
- Recovery of all metals 100% including non ferrous metals. This guarantees considerable additional revenues!
- Treatment in closed tanks, so there are no environmental effects such as smell or water contamination



Large Variety of Input Materials:

- Organic household waste in various compositions
- Any type of organic material (food waste, residues from fruit pressings, olive oil treatment, straw, etc.)
- Any type of plastics (PE, PP, PVC, PET, PS, etc.)
- Any type of wood (trees, branches, chips, saw dust), even highly contaminated wood such as railway sleepers, old furniture, etc.
- Textiles, diapers, hides, rubber
- Paper, carton
- Sludge from settling tanks and waste water treatment facilities
- Slaughter house waste
- Hazardous/toxic wastes
- Hospital waste
- Electronic waste
- Waste from existing landfills, thus reducing its size and recovering valuable land
- Also residues from anaerobic digestion processes, if not saleable (digestate, compost)

Products obtained from „First Stage“ BioTech Anaerobic Digestion Process

- **Biogas is a combustible gas which consists 65 – 70% of pure methane, with a calorific value of 6.5 kWh per standard m³ . This biogas is converted into energy but may also be used as a substitute for natural gas**
- **Compost generated by anaerobic digestion is a fully stabilised non-smelling soil substrate without any requirement for further aerobic after-composting.**

Its basic properties:

- **compost still contains all the fertilising salts which the plants have absorbed during growth**
- **compost has a high content of huminous acids which reactivate “dead” soil, which has been overexploited by heavy chemical fertilising**
- **Toxic matter like heavy metals etc. are approx. at 50% of permissible levels thus meeting easily EC or EPA US standards**
- **compost assures a loose top soil with optimum soil aeration and water maintenance conditions**

Photo Demonstration

Input Material

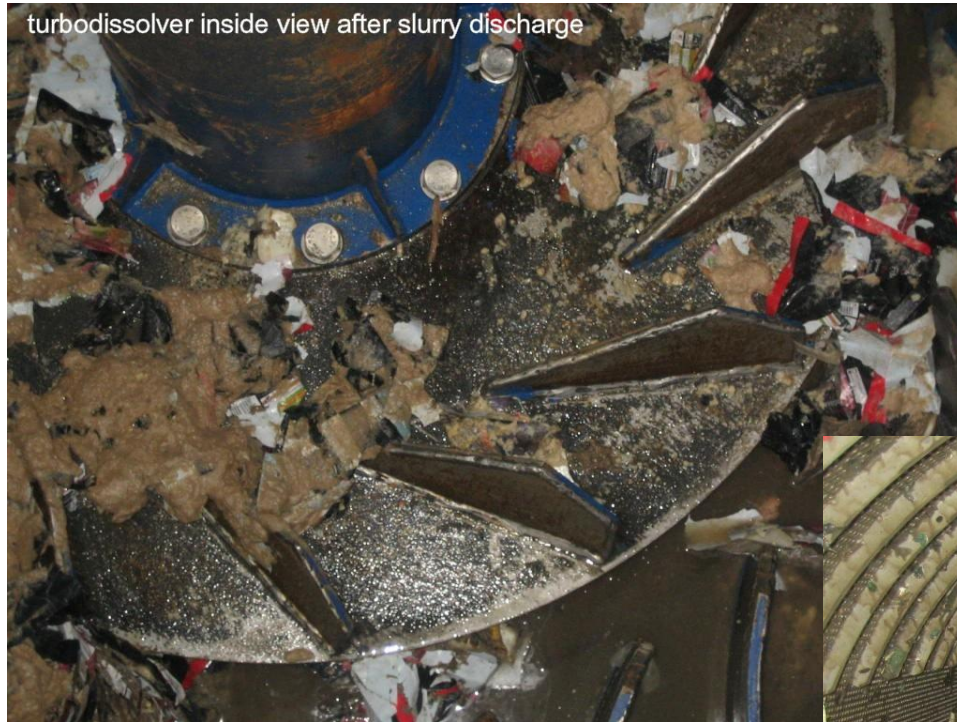


Photo Demonstration cont'd



High speed turbo-dissolvers

Photo Demonstration cont'd



rotating screen for separation of "lights" from slurry

Photo Demonstration cont'd



Compost after anaerobic digestion



compost



heavy weight residual waste fraction



Photo Demonstration cont'd

**Output from BioTec
First Stage
Anaerobic Digestion =**

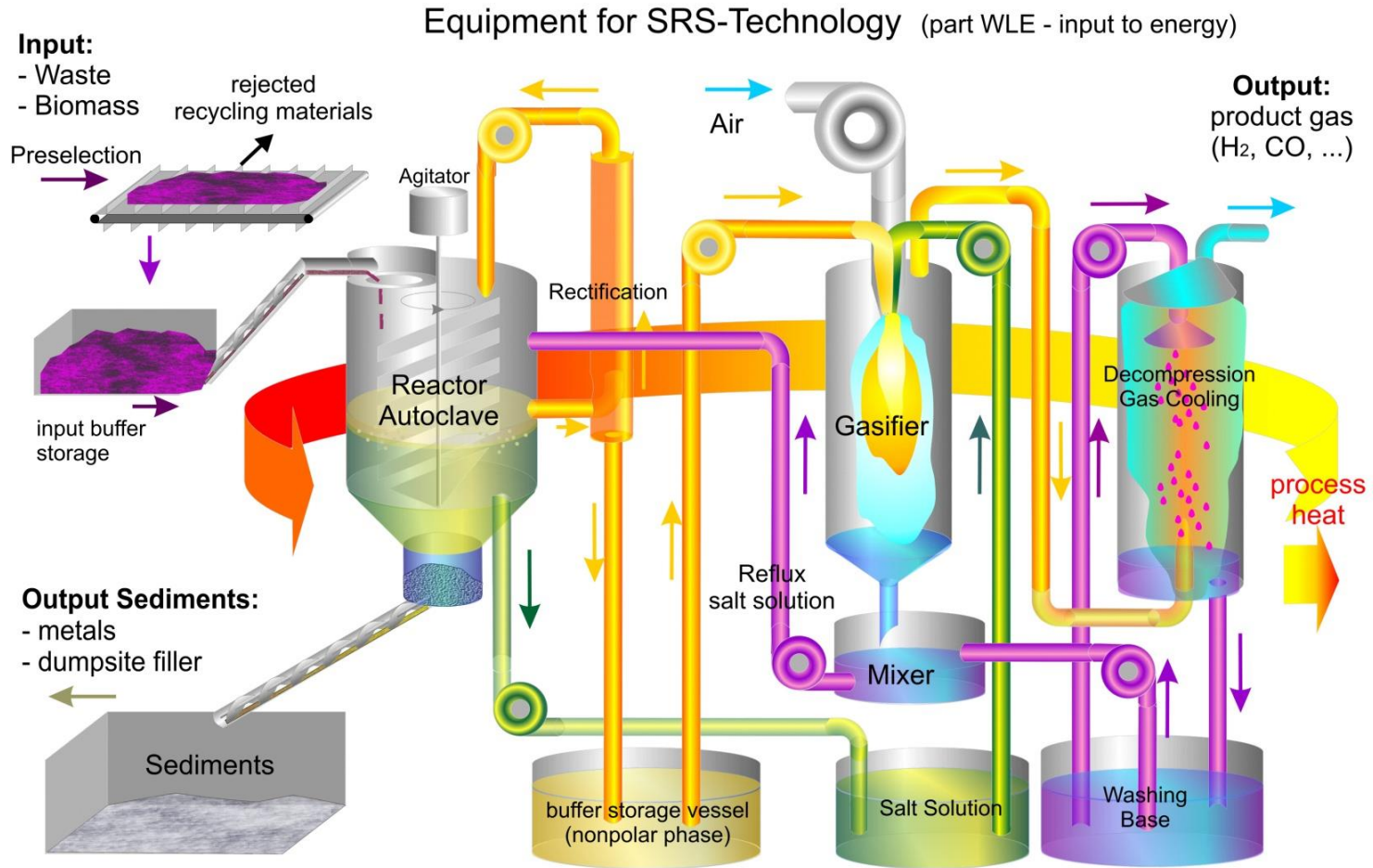


**= Input into
Second Stage
SRS Gasification**

SRS (Selective Residue Solvolysis) – the second Stage

- Anaerobic digestion cannot treat cellulose and plastics, but cellulose and plastics contain the bulk of the energy!
- Accordingly the SRS stage increases energy output by 3 – 4 times!
- No-burn, no-emission technology
- > 80% energy conversion !
- Moderate process conditions (150 - 250 °C, depending of type of input material)
- Large variety of input materials, also wet, contaminated!
- Output in form of clean synthesis gas ($\text{CO} + \text{H}_2$), free from tar, free from particles
- Safe elimination of toxic ingredients (halogens, heavy metals)
- Only mineral residues consisting of sand, silicates, broken glass, etc. and possibly certain insoluble (untoxic) salts (approx. 4-8%).

Process Description



Process Description cont'd

- **A) Liquefaction**
- **input materials are mixed into a concentrated and saturated salt solution**
- **A chemical reaction at approx. 200 °C loosens the bonding of the molecular structures, causing disintegration and dissolving**
- **Complex cellulose/lignin molecules are degraded into soluble organic salts**
- **Mineral (insoluble) particles sediment at the bottom of the reactor vessel**
- **If necessary special additives will buffer toxic elements such as chlorine, bromine, heavy metals etc. into insoluble compounds which are also eliminated by sedimentation**
- **100 % elimination and recovery of all metals**
- **The remaining solution consists of an energy-rich watery solution of organic salts**



Process Description cont'd

B) Gasification

- The liquid solution is pumped to a gasifier, resulting in a pure, tar-free synthesis gas ($H_2 + CO$)
- Salts used for preparing the solution precipitate in form of a smelter along the walls of the gasifier, from where they will be recovered for reuse in the reactor (no consumable)

C) Energy Conversion

- The generated synthesis gas is decompressed and cooled down and taken to a CHP motor-generator-set
- Excess heat is available for the process itself, but also for external use with various options including conversion into cooling energy

Large Variety of Input Materials



Large Variety of Input Materials



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