# ZEOLOGIC

SUBSIDIARY OF **MYTILINEOS**

## Landfill Leachate

Design, construction, installation and maintenance of waste treatment plants

### Approach

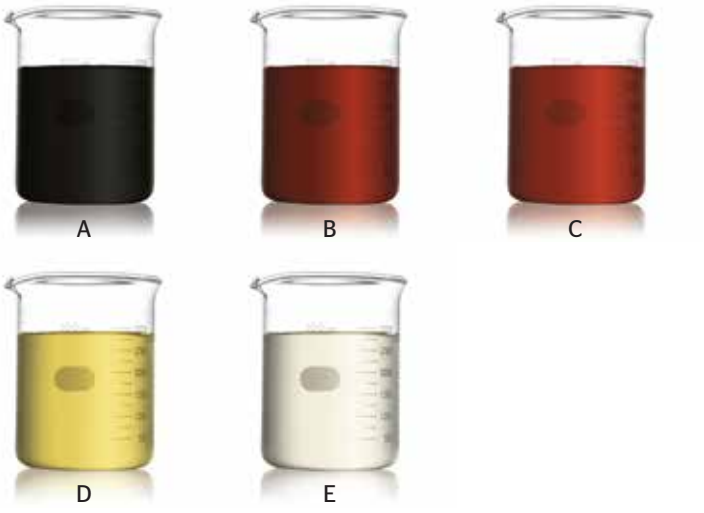
**The power of nanotechnology in environmental protection**

Landfill leachate, a natural result of landfilling, constitutes a global environmental problem and a significant source of pollution. It has very high pollution load, as it contains the toxicity of the total liquid waste of the landfill.

The pollutants that appear in leachate are heavy metals, several hydrocarbons, aromatic compounds, phenol, etc., compounds that are particularly difficult to treat and at high cost to date.

Through innovative technologies, high-quality EPC and Maintenance services, **ZEOLOGIC** provides an effective treatment for landfill leachate.

**Visual observation at various stages of treatment for a landfill leachate sample**

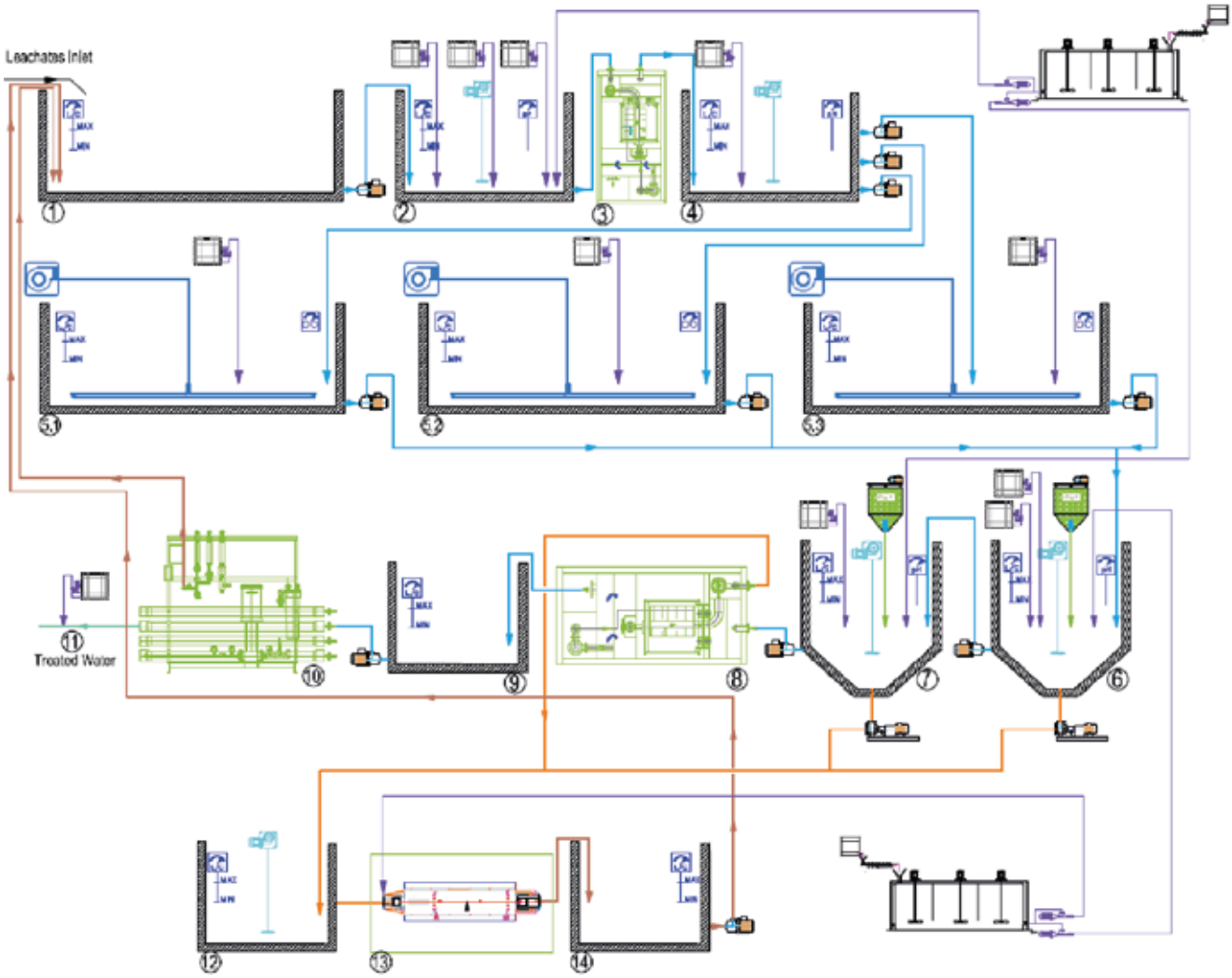



**A.** Raw landfill leachate
**B.** After coagulation-filtration
**C.** After chemical oxidation
**D.** After geochemical reaction
**E.** After reverse osmosis

Municipal waste water

Typical control panel of a ZEOLOGIC installation

Consumables dosing pumps




## Legend

| | |
|---|---|
| 1 | Pre-Storage Tank |
| 2 | Primary Flocculation |
| 3 | Mechanical Filtration Flocculated Macromolecules |
| 4 | pH Adjustment |
| 5.1 - 5.3 | Chemical Oxidation |
| 6 | Main Geochemical Treatment |
| 7 | Secondary Geochemical Treatment |
| 8 | Mechanical Filtration |
| 9 | Buffer Tank |
| 10 | Reverse Osmosis System |
| 11 | Purification |
| 12 | Sludge Dehydration |
| 13 | Sludge Drying (Decanter) |
| 14 | Leachates Storage Tank |

**Wastewater line:**

**Chemical Solutions line:**

**Measuring Instruments:**

**Aeration line:**

**Electromechanical Equipment:**

**Geopolymec line:**

**Sludge line:**

**Reverse Osmosis Rinsing - Leachate:**

**Treated Water:**

**Technical Description of Leachates from Landfills using the GACS (Geochemical Active Clay Sediment) method**
The treatment of Leachates from MSW Landfills wastewater Treatment plant using the GACS method, includes the following stages:

**i. Pre-Storage:** Firstly, incoming Leachate is stored in the pre-storage tank (1). (Pre-storage is optional and required when the treatment is batch type.)

**ii. Primary Flocculation:** Wastewater is pumped in the Primary Flocculation tank (2). Continuous stirring homogenizes the mixture. Automated dosing systems are used to add the appropriate chemical solutions to complete the process within the tank.

**iii. Mechanical Filtration of Flocculated Macromolecules:** When the Primary Flocculation completes, wastewater is pumped in the mechanical filtration stage with a fully automated prefabricated filter for the removal of the Flocculated macromolecules (3). Backwash discharges are driven in the sludge neutralization tank (12).

**iv. PH Adjustment:** After the mechanical filtration the wastewater is pumped into the PH Adjustment tank (4). Continuous stirring homogenizes the mixture. Automated dosing systems are used to add the appropriate chemical solutions to complete the process.

**v. Chemical Oxidation:** Wastewater is pumped in the chemical oxidation tanks (5.1-5.3). Blowers are initiating the process. Automated dosing systems add the proper chemical solutions to speed up the process. When the chemical reaction completes, water is pumped in the main geochemical treatment tank (6).

**vi. Main Geochemical Treatment:** Wastewater is pumped in the tank of the main geochemical treatment (6), where the chemical load is captured by the active geopolymers. Continuous stirring homogenizes the mixture. Automated dosing systems are used to add the geopolymers and the appropriate chemical solutions (such as polyelectrolytes), to complete the process. The sludge produced after the treatment is pumped in the sludge neutralization tank (12).

**vii. Secondary Geochemical Treatment:** When the main geochemical treatment completes, wastewater is pumped in the tank of the secondary geochemical treatment (7) where the rest of the chemical load is captured by active geopolymers. Continuous stirring homogenizes the mixture. Automated dosing systems are used to add the geopolymers and the appropriate chemical solutions, to complete the process. The sludge produced after the treatment is pumped in the sludge tank (12).

**viii. Final Mechanical Filtration:** The geochemical treatment stages are followed by the mechanical filtration stage (8), with a fully automated filter for the removal of any remaining suspended solids. Backwash discharges are sent to the sludge tank (12).

**ix. Buffer tank:** When the mechanical filtration is completed, wastewater has been stored in a buffer tank (9) for the hydraulic balancing, before the reverse osmosis system (10).

**x. Reverse Osmosis (optional):** When necessary, and in order to achieve the required conductivity, wastewater is pumped in a reverse osmosis system (10) to acquire the proper electrochemical characteristics for safe disposal. Reverse osmosis concentrate is pumped in the pre-storage tank (1), before it continues to the next treatment stages. Under this process, the total amount of wastewater produced is treated before safe disposal.

**xi. Water Purification:** Water purification occurs before safe disposal of the treated wastewater by adding chemical solutions for a specific amount of time such as NaOCl for the disinfection of the treated wastewater.

**xii. Sludge Dehydration:** Sludge produced in the main geochemical treatment stage (6), the secondary geochemical treatment stage (7), and the mechanical filters (3-8), is pumped in the Sludge Dehydration tank (12). Stirrers are used to homogenize the mixture to inert the final sludge. Sludge drying can be accomplished either by using a decanter (13) or a filterpress. Inert dry sludge can be safely disposed without further treatment. Leachate produced after the decanter, or the filterpress, are gathered in the leachate storage tank (14) and pumped back to the pre-storage tank (1).

- All of the stages described above are fully automated and controlled through a Programmable logic controller (PLC).
- On-site control and interference with the operation of the unit is done via a touchscreen HMI (Human-machine interface).
- Supervisory control and data collection is done through the SCADA system (Supervisory Control And Data Acquisition).
- Remote control and operation of the unit is possible. Wireless communication for remote control can be done via mobile phone, tablet and PC.

Chemical analysis of a typical leachate sample before and after treatment with ZEOLOGIC GACS method

| Parameter | Unit | Initial measurement | Final measurement |
|---|---|---|---|
| **C OD** | **mg/L** | **24,730** | **> 99.5% reduction** |
| **BOD** | **mg/L** | **5,735** | **< 25** |
| Total Solids (103°C) | mg/L | 31,224 | > 99.5% reduction |
| Suspended Solids | mg/L | 519 | > 99.9% reduction |
| Total dissolved solids | mg/L | 30,335 | > 99.5% reduction |
| **Total Nitrogen** | **mg/L** | **1.430** | **> 99.5% reduction** |
| Organic Nitrogen | mg/L | 646 | > 99.9% reduction |
| **Ammoniacal Nitrogen** | **mg/L** | **784** | **> 99% reduction** |
| TOC | mg/L | 9.879 | > 99.9% reduction |
| Total Phosphorus | mg/L | 62.25 | > 99.9% reduction |
| Surfactants | mg/L | 4.22 | ND |
| pH | - | 9.70 | 8.00 |
| Conductivity | μS/cm | 36,925 | > 96.9% reduction |
| Temperature | °C | 25.10 | 25.10 |
| Smell | TON | 198 | > 98% reduction |
| Turbidity | NTU | 621 | > 95% reduction |
| Chlorides | mg/L | 5,393 | > 90% reduction |
| Sulphates | mg/L | 245 | > 99.5% reduction |
| **Phenols** | **mg/L** | **82.3** | **< 0.5** |
| Chromium | mg/L | 1.14 | > 99% reduction |
| Magnesium | mg/L | 6.30 | > 99% reduction |
| Manganese | mg/L | 1.20 | > 99.1% reduction |
| Lead | mg/L | 2.21 | > 99% reduction |
| Cobalt | mg/L | 5.30 | > 99% reduction |
| **Iron** | **mg/L** | **735** | **> 99.2% reduction** |
| **Arsenic** | **μg/L** | **340** | **> 99.2% reduction** |
| **Cadmium** | **μg/L** | **2.11** | **ND** |
| **Cuprum** | **μg/L** | **477** | **> 99% reduction** |
| **Nickel** | **μg/L** | **1,913** | **> 98.7% reduction** |
| Zincum | μg/L | 1,006 | > 99.1% reduction |
| Sodium | μg/L | 1,600 | > 92.5% reduction |
| Potassium | μg/L | 800 | > 91.6% reduction |

**Contact information**

Industrial Area of Thessaloniki Sindos Greece Block 8/3A-10 Post Office Box 1086
Postal Code 570 22 T: +30 2310 251243 E: info@zeologic.gr
www.zeologic.gr