Innovative electro dewatering system for the maximisation of the urban sludge dry solid content

BACKGROUND AND PROJECT GOALS

The European “Urban Waste Water Treatment Directive” (UWWTD-91/271/EEC) has promoted the treatment of sewage, resulting in a strong increase in sludge production.

Best available technologies for sludge dewatering achieve dry solid (DS) content up to 25-40% by technologies needing for large quantities of chemicals and energy.

The main objective of ELECTRO-SLUDGE is to design, develop and demonstrate an innovative sustainable electro-osmotic dewatering system, able to dewater urban sludge from wastewater treatment plants (WWTPs) up to a DS content equal to or greater than 30%.

ELECTRO-SLUDGE will reduce the volume and weight of urban sludge, and consequently: (i) it will reduce the amount of waste to land filling and to incineration, (ii) it will drastically reduce sludge volumes to be transported to final disposal, limiting environmental impacts due to transport.

PROCESS FUNDAMENTALS

Electro-osmosis consists in the application of an electric field, forcing water molecules to move out from sludge and to pass through a porous filter. A prototypal machine for the electro-dewatering of sludge in continuous has been patented (WO 2011/161568 A1) and it is shown in Figure 1. A rendering of the prototype in WWTP is reported in Figure 4.

PRELIMINARY RESULTS

Preliminary electro-dewatering tests were performed at POLIMI by means of a lab-scale device (Figure 2). Mechanically dewatered sludge samples were taken from the four WWTPs, being described in Table 1, and experimental results are reported in Figure 4.

Table 1. WWTPs that provided sludge for preliminary tests

<table>
<thead>
<tr>
<th>WWTP</th>
<th>Design capacity (t/year)</th>
<th>Process</th>
<th>Sludge stabilization</th>
<th>Sludge dewatering</th>
<th>DS content (in %)</th>
<th>Dewatered sludge (t/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locate (T)</td>
<td>50,000</td>
<td>AS</td>
<td>Aerobic</td>
<td>Belt press</td>
<td>17%</td>
<td>2,334</td>
</tr>
<tr>
<td>San Giuliano Est</td>
<td>80,000</td>
<td>AS</td>
<td>Aerobic</td>
<td>Centrifuge</td>
<td>18%</td>
<td>4,277</td>
</tr>
<tr>
<td>Basiglio</td>
<td>16,000</td>
<td>AS + MBR</td>
<td>Aerobic</td>
<td>Belt press</td>
<td>16%</td>
<td>797</td>
</tr>
<tr>
<td>Peschiera B.</td>
<td>500,000</td>
<td>AS + BAF</td>
<td>Anaerobic</td>
<td>Centrifuge</td>
<td>26%</td>
<td>14,762</td>
</tr>
</tbody>
</table>

Figure 1. Electro-dewatering prototype machine: (a) patent representation, (b) technical scheme

Figure 2. Lab-scale device for electro-dewatering tests

Figure 3. Rendering of electro-dewatering prototype in WWTP

Figure 4. Electro-dewatering results from preliminary tests on sludge from four WWTPs: DS values and energy consumptions