Management of digestate quality for utilization as fertiliser
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http://www.iea-biogas.net/_content/publications/publications.php
Quality features of digestate used as fertiliser

**Declared content**  
NPK, pH-value, DM, VM…

**Purity**  
Physical impurities: plastic, stones, glass, metals …

**Biological safety**  
Pathogens and other undesired biological content

**Chemical safety**  
Chemical pollutants: inorganic (e.g. heavy metals) and organic compounds (e.g. POPs)
Why is digestate quality important

- Excellent fertiliser
- Recycling as fertiliser - the most sustainable use
- High potential worldwide
- Limited by insufficient confidence in its quality
- Impact on food safety, health and environment
- Public acceptance: barrier or incentive for AD
- Guarantee of quality necessary
AD feedstock
key element of digestate quality

- Animal manure and slurries
- Vegetable biomass residues (agriculture, horticulture, forestry)
- Organic wastes from agro-food and feed industries (vegetal/animal)
- Whole crops (energy crops) and parts of crops
- Organic household waste/food remains (vegetal/animal)
- Animal by-products (European ABP1069/2009)
- By-products from biorefineries and other industrial processes (glycerol, tannins, bleaching clay etc)
- Aquatic biomass
- Other

"What you put in, comes out"
# Unwanted impurities

## Physical impurities

**What are**
- Non-digestible materials
- Large pieces of digestible

**Management measures**
- Exclusion of highly polluted material
- Positive lists + ongoing control (feedstock and digestate)
- Source separation/separate collection
- Pre-treatments of feedstock (chopping, maceration)
- Physical barriers (screens, sieves, stone traps, protection grills)

## Biological contaminants

**What are**
- Animal and human pathogens
- Plant pathogens, weed seeds

**Management measures**
- Exclusion of high risk materials
- Positive lists + ongoing control (feedstock and digestate)
- Sanitation effect of the AD
- Pre-sanitation of feedstock
- Post-sanitation of digestate

*Good knowledge and quality management tools in both cases!*
Unwanted impurities

Chemical pollutants

What are

Inorganic pollutants

Heavy metals (HM): Cd, Pb, Hg, Ni, Zn, Cu, Cr

Organic pollutants (OP)

Persistent organic pollutants (POPs)
Emerging organic pollutants
Other xenobiotic compounds

Effects

Toxic to biota, persistence and bioaccumulation, eco-toxicity, unknown long term effects

Management measures

• Exclusion from AD of unsuitable materials/limit values

• Positive lists + ongoing control (feedstock and digestate)

• Research and knowledge update
Quality management of digestate

Critical check points (Source: Al Seadi and Lukehurst, 2012)

Digestible wastes

Animal production

Clean technologies
Quality standards

Feedstock selection/ Positive lists
Quality standards/ Quality control
Pre-treatments

Digestion/Degradation
Sanitation

Quality standards/quality control
Post treatments
Declaration

Crop production

AD feedstock

AD

Digestate
Quality assurance/ National standards

**Main drivers**

- Overall improved confidence in digestate
- Enhanced recycling as fertiliser
- Prevention of health and environmental hazards
- Improved veterinary safety
- Positive effect on food safety
- Better market conditions for high quality digestate
- Enhanced public acceptance of biogas in general
- Removal of barriers/create incentives for the development of AD
- Cleaner technologies
- Others
Quality assurance/ National standards

Means

- Supportive legislative frames (environment, waste, agriculture or combinations hereof)
- Certification systems and quality standards / limit values for specific pollutants
- Positive lists of materials suitable as AD feedstock (only a guide, must be updated, do not supersede quality control)
- Guidelines of recommended practices of digestate use
- **On-going knowledge update and information at all levels**
# Quality assurance/ National standards

Example of limit values of HM in (mg/kg DM) in ‘waste’ products applied on land

(Source: Al Seadi and Lukehurst, 2012)

<table>
<thead>
<tr>
<th>Country/Region</th>
<th>Cd</th>
<th>Pb</th>
<th>Hg</th>
<th>Ni</th>
<th>Zn</th>
<th>Cu</th>
<th>Cr</th>
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<tbody>
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<td>Austria</td>
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<td>-</td>
<td>-</td>
<td>100</td>
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<td>62</td>
<td>500</td>
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<td>210</td>
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<td>120</td>
<td>0.8</td>
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<td>4000</td>
<td>1000</td>
<td>100</td>
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<td>100</td>
<td>1</td>
<td>100</td>
<td>150</td>
<td>600</td>
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<td>800</td>
<td>10</td>
<td>200</td>
<td>3000</td>
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<tr>
<td>Germany</td>
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<td>2500</td>
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<td>2500</td>
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<td>1</td>
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<td>800</td>
<td>600</td>
<td>100</td>
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<tr>
<td>Switzerland</td>
<td>1/0.7</td>
<td>120/45</td>
<td>1/0.4</td>
<td>30/25</td>
<td>400/200</td>
<td>100/70</td>
<td>70/-</td>
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<tr>
<td>The Netherlands</td>
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<td>0.75</td>
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<td>300</td>
<td>75</td>
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<tr>
<td>United Kingdom</td>
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<td>200</td>
<td>1</td>
<td>50</td>
<td>400</td>
<td>200</td>
<td>100</td>
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</table>
Quality assurance/ National standards

Example of limit values of OP in ‘waste’ products applied on land
(Source: Al Seadi and Lukehurst, 2012)

<table>
<thead>
<tr>
<th>Organic pollutant</th>
<th>Country</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Austria (Drägerfallverordnung, 2004)</td>
</tr>
<tr>
<td>PAHs</td>
<td>6 mg/kg DM</td>
</tr>
<tr>
<td>PCDD/F (TE/kg DM)</td>
<td>20 ng/kg DM</td>
</tr>
<tr>
<td>Chlorinated pesticides (HCH, DDT, DDE etc)</td>
<td>0.5 mg/kg Product</td>
</tr>
<tr>
<td>PCB</td>
<td>0.2 mg/kg DM</td>
</tr>
<tr>
<td>AOX</td>
<td>500 mg/kg DM</td>
</tr>
<tr>
<td>LAS</td>
<td></td>
</tr>
<tr>
<td>NPE</td>
<td></td>
</tr>
<tr>
<td>DEPH</td>
<td></td>
</tr>
</tbody>
</table>
Summing up

- **Recycling** as fertiliser - the most **sustainable** utilization

- Significant **impact** and **high potential** worldwide

- Limited by **insufficient confidence** in its quality and safety

- **Quality management** (QM) / quality assurance implemented by increasing number of countries
  - **Aim**: guarantee high quality => ease market penetration => enhance safe use as fertiliser
  - **Requires**: supportive legislation, “clean” AD feedstock, on-going quality control, knowledge update, responsible attitude of all actors

“Clean” AD feedstock - the key element

For more information, please visit
http://www.iea-biogas.net/_content/publications/publications.php
Thank you for your attention