Management of digestate quality for utilization as fertiliser

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Content

1. Rationale
2. Managing digestate quality
3. Quality assurance/National standards
4. Summing up

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, commes 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)
  - Animal By-Product Regulation EC1069/2009
    - www.eur-lex.europa.eu
- Snitation 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)
- Pre/post treatment processes (relative efficiency)
- Need for more research and knowledge update
Quality management of digestate

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

Digestable wastes → AD feedstock

Animal production → AD

Crop production → Digestate

A

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

B

Digestion/Degradation
Sanitation

C

Quality standards/quality control
Post treatments
Declaration
Quality assurance/ National standards

Drivers

- Confidence in digestate quality and enhanced use as fertiliser
- Prevention of health and environmental hazards; improved veterinary and food safety
- Better market conditions for high quality digestate
- Enhanced public acceptance of biogas; Incentives for the development of AD
- Promotion of cleaner technology

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 and information up-date
## Quality assurance/ National standards

### Example of European limit values of heavy metals (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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<td>EU, recommendations</td>
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<td>750</td>
<td>16</td>
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<td>3</td>
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<td>0.6</td>
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<td>Denmark</td>
<td>0.8</td>
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<td>0.8</td>
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<td>0.75</td>
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<td>1</td>
<td>50</td>
<td>400</td>
<td>200</td>
<td>100</td>
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</tbody>
</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>OP (Organic pollutant)</th>
<th>Country 1</th>
<th>Country 2</th>
<th>Country 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OP (Organic pollutant)</strong></td>
<td>(Düngemittelverordnung, 2004)</td>
<td>(Slambekendtgørelsen, 2006); Danish Ministry of Environment</td>
<td>(Guidelines for utilisation of compost and digestate, 2010)</td>
</tr>
<tr>
<td>PAHs (Polycyclic aromatic hydrocarbons)</td>
<td>6 mg/kg DM</td>
<td>3 mg/kg DM</td>
<td>4 mg/kg DM</td>
</tr>
<tr>
<td>PCDD/F (Dioxins and furans)</td>
<td>20 ng TE/kg DM</td>
<td></td>
<td>20 ng I-TEC/kg DM</td>
</tr>
<tr>
<td>HCH, DDT, DDE etc. (Chlorinated pesticides)</td>
<td>0.5 mg/kg Product</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCB (Polychlorinated biphenyls)</td>
<td>0.2 mg/kg DM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AOX (Absorbable organic halogens)</td>
<td>500 mg/kg DM</td>
<td></td>
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<tr>
<td>LAS (Linear alkylbenzene sulphonates)</td>
<td></td>
<td>1300 mg/kg DM</td>
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</tr>
<tr>
<td>NPE (Nonylphenol and nonylphenoletoxylates)</td>
<td></td>
<td>10 mg/kg DM</td>
<td></td>
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<tr>
<td>DEPH (Di (2-ethylhexyl) phthalate)</td>
<td></td>
<td>50 mg/kg DM</td>
<td></td>
</tr>
</tbody>
</table>

*I-TEC: International Toxicity Equivalents*
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
Quality management of digestate from biogas plants

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For more information, please visit

http://www.iea-biogas.net/_content/publications/publications.php
Thank you for your attention