



# Management of digestate quality for utilization as fertiliser

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# 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)



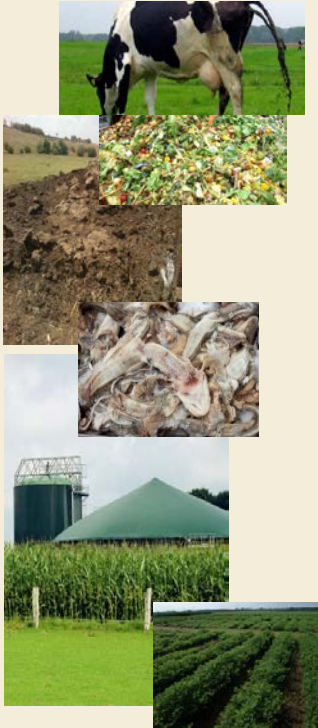
# Why is digestate quality important

- 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)

**Animal By-Product Regulation EC1069/2009**  
[www.eur-lex.europa.eu](http://www.eur-lex.europa.eu)

- 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

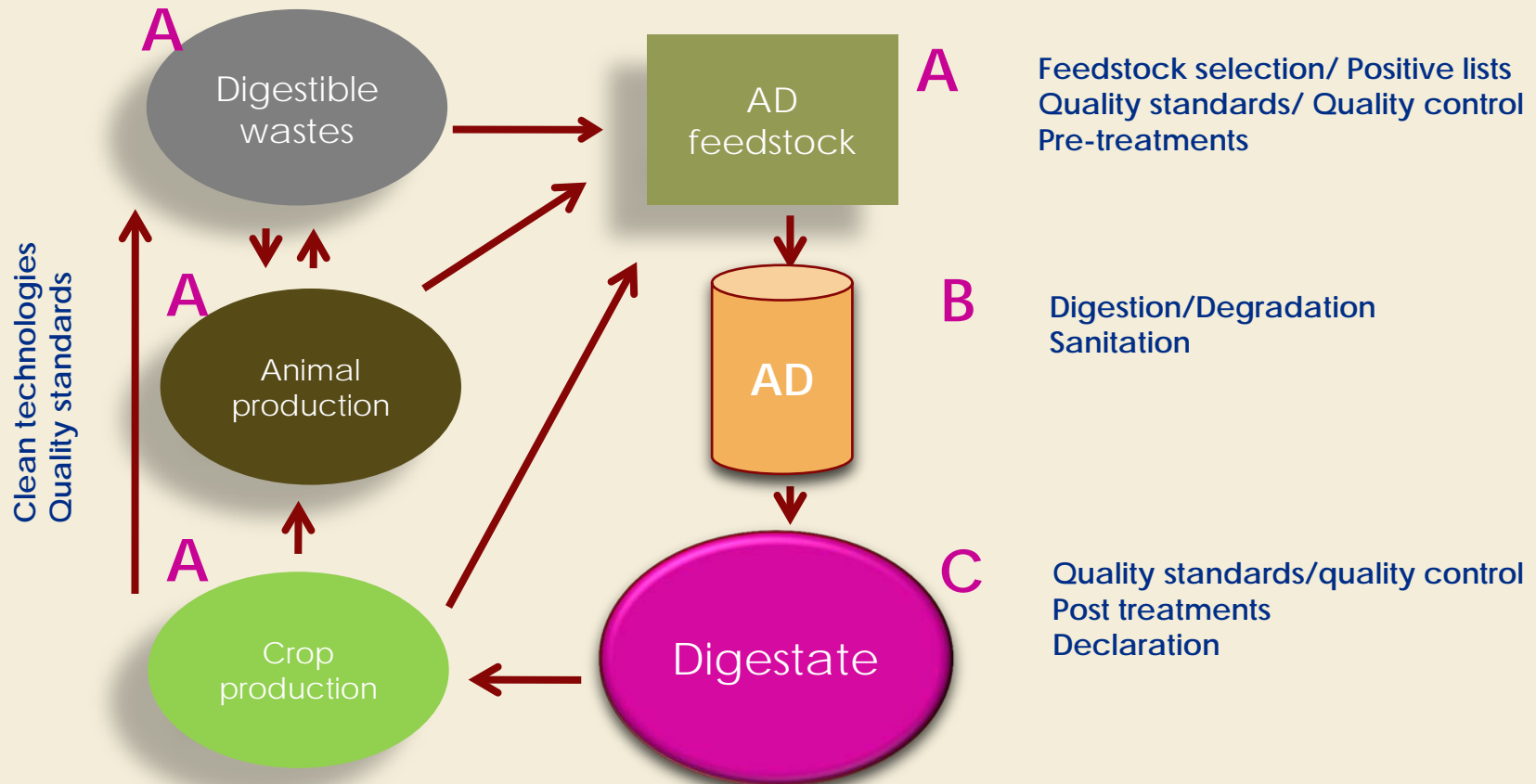
Toxic to biota, persistence and bioaccumulation, eco-toxicity, unknown long term effects

### Management measures

- Exclusion from AD of unsuitable materials/ limit values
- Positive lists + ongoing control ( feedstock and digestate)
- 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)





# 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 technologies

## 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)

Country/Region	Cd	Pb	Hg	Ni	Zn	Cu	Cr
EU, recommendations	20	750	16	300	2500	1000	1000
EU, recommendations starting 2015	5	500	5	200	2000	800	600
EU, recommendations starting 2025	2	300	2	100	1500	600	600
Austria	3	100	1	100	-	-	100
Canada	3	150	0,6	62	500	100	210
Denmark	0.8	120	0.8	30	4000	1000	100
Finland	1.5	100	1	100	1500	600	300
France	3	180	2	60	600	300	120
Germany	10	900	8	200	2500	800	900
Ireland	20	750	16	300	2500	1000	1000
Norway	2	80	3	50	800	650	100
Sweden	1	100	1	50	800	600	100
Switzerland	1	120	1	30	400	100	70
The Netherlands	1.25	100	0,75	30	300	75	75
United Kingdom	1.5	200	1	50	400	200	100

# Quality assurance/ National standards

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

OP (Organic pollutant)	Country		
	<i>(Düngemittelverordnung, 2004)</i>	<i>(Slambekendtgørelsen, 2006); Danish Ministry of Environment</i>	<i>(Guidelines for utilisation of compost and digestate, 2010)</i>
<b>PAHs</b> (Polycyclic aromatic hydrocarbons)	6 mg/kg DM	3 mg/kg DM	4 mg/kg DM
<b>PCDD/F</b> (Dioxins and furans)	20 ng TE/kg DM		20 ng I-TEC/kg DM
<b>HCH, DDT, DDE etc.</b> (Chlorinated pesticides)	0.5 mg/kg Product		
<b>PCB</b> (Polychlorinated biphenyls)	0.2 mg/kg DM		
<b>AOX</b> (Absorbable organic halogens)	500 mg/kg DM		
<b>LAS</b> (Linear alkylbenzene sulphonates)		1300 mg/kg DM	
<b>NPE</b> (Nonylphenol and nonylphenoethoxylates)		10 mg/kg DM	
<b>DEPH</b> Di (2-ethylhexyl) phthalate)		50 mg/kg DM	

\*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](http://www.iea-biogas.net/_content/publications/publications.php)

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**Thank you for your  
attention**