EUROPEAN POLICY ON BIODEGRADABLE WASTE: A MANAGEMENT PERSPECTIVE

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ABSTRACT

The main characteristics of the European environmental policy are reviewed. Focusing on EU policy on waste, the paper presents the principles in which EU waste management is founded, particularly the waste hierarchy. In this hierarchy, priority shall be given to prevention of the generation of wastes and of its hazardousness. Secondly, the reuse and the recovery of materials (recycling), which implies the separation of waste at source involving consumers in the scheme of waste management. Priority should be given to material recycling over energy recovery. The less desirable option is the disposal of waste. The paper reviews specific Directives on organic waste management, following the scheme of the waste hierarchy, together with the general trend observed in producing common regulations for all types of organic residuals. Afterwards, key issues and measures for the implementation of a feasible strategy for organic residuals management, e.g. quality requirements and quality assurance, are discussed. Finally, there is a view on manager´s perspective on the current EU policy, public acceptance and suitable waste management operations.

KEYWORDS

Biowaste, biodegradable waste, UE legislation, organic waste, waste

AN OVERVIEW ON EU ENVIRONMENTAL POLICY

The European Union (EU) history began in 1951 with the agreement of six countries (Belgium, Germany, France, Italy, Luxembourg and the Netherlands). Today it is composed of fifteen Members States, and it is on the way to its fifth enlargement towards Eastern and Southern Europe (Figure 1).

EU institutional system is based upon three main institutions: the *Council of the European Union*, the *European Parliament* and the *European Commission* (or "European Government"). Environment is one of the matters on which Member states delegate sovereignty on the EU.

The Parliament and the Council share the power to legislate, (Directives, Decisions, Regulations, etc). The Commission, through Directorate General XI (DG XI- "Environment and Nuclear Safety") has the task to promote and propose draft legislation on environment.

EU Directives are mandatory for the Member States, although its requirements are frequently hardened in national or regional rules. Directives establish in some cases the general principles (Framework Directives), or specific regulations or quality objectives.

The objectives of EU environmental policy have been presented in successive action programs since 1973 (*1st Environmental Action Program*). Environmental strategy has evolved from remediation actions to a quite different approach focused on preventive action.

5th Environment Action Program (1992-2000) is based upon "*the precautionary principle"* (Art 174.2 of the Treaty), in the frame of "*sustainable development"*.

6th Environment Action Program (2001-2010)*:"Our future, our choice"*, pays special attention on the integration of environmental aspects in the formulation of sectorial policies, setting out five key goals:

- Ensure the implementation of existing environmental legislation
- Integrate environmental concerns into all relevant policy areas
- Work closely with business and consumers to identify solutions
- Ensure better and more accessible environmental information for citizens
- Develop a more environmentally conscious attitude towards land use

The new program identifies four priority areas:

- Climate Change
- Nature and Biodiversity
- Environment and Health
- Natural resources and Waste

WASTE POLICY AND "WASTE HIERARCHY"

The EU waste management policy is founded in some key principles:

- "*Prevention principle"*: production must be minimized where possible.
- "*Producer responsibility and polluter pays principle"*.
- "*Precautionary principle"*: should anticipate potential problems.
- "*Proximity principle"*: to treat and dispose waste as closely as possible to generation site.

The Directive on Waste 75/442/EEC (amended by the Directive 91/156/EEC), is considered the "*Waste Framework Directive"*. Member States are called to adopt the measures to encourage the prevention and reduction of waste and its potential harmful effects. "*European Waste Catalogue (EWC)"*, which is a non-exhaustive list of wastes, periodically revised, completes the 91/156 Directive.

EU strategy for Waste Management (July 1996) confirms the hierarchy of principles established in 1989, considering the following order of priority:

I. Prevention of the generation of wastes and of its hazardousness. Promotion of clean technologies and products, the reuse and recycling schemes, eco-audit schemes, and complementary actions on consumer information and education altogether with the european eco-label system.

II. Reuse, recovery of materials (recycling) and energy recovery. Priority should be given to direct reuse and material recycling. Less preferred alternatives are energy recovery operations, and the last option would be the mere thermal destruction of waste. Special emphasis is done in waste selection at the source, involving the society in waste policy.

III. Disposal. Disposal of stabilized waste in a way that does not harm human health or the environment.

REVIEW OF EU BIOWASTE MANAGEMENT DIRECTIVES

Waste generation prevention

Prevention principle includes qualitative and quantitative prevention.

The main sources of biowaste to reduce in EU countries are:

- Organic fraction of urban waste
- Wastewater sludge or biosolids
- Manure and animal residuals
- Industrial waste and sludge, green and garden refuses and other sources

Organic waste reduction is one of the most important issues in EU waste policy. The 60% of urban wastes is organic and there are other wastes like sewage sludge or biosolids whose production is increasing. The implementation of the European regulation on wastewaters by all member States will increase the amount of sludges produced. We are again in the known dynamic: problem (wastewater), solution (treatment) new problem (sewage sludge). Here, the waste hierarchy cannot be observed because the reduction is impossible.

Organic waste is not an exception. That principle supposes for all EU members that they must make all their best in order to reduce the waste generation, including organic, applying the best available technologies.

Here we should make reference to the IPPC (**Integrated Pollution, Prevention and Control Directive, 96/61/CEE**), destined to prevent, reduce and eliminate pollution at the source through the sustainable use of natural resources. It protects water, soil and air from emissions stating that any "installation" covered by this Directive requires a permit to operate and any emissions from that facility would be reportable. The type of waste management facilities that fall under this Directive are primarily landfill and energy from waste plants.

Reuse and Recycling (Land application, composting…)

After prevention, the second step is the reuse and the recycling of waste, including the organic waste.

The European Commission focuses on the need of promoting waste recovery trying to reduce the quantity of waste for disposal and saving natural resources, by means of reuse, recycling, composting and energy recovery from waste. That is why, the EU has promulgated various regulations (Directives, Decisions...) in order to recycle the organic waste as fertilizer, compost or soil amendment.

The first disposition in this sense is the **Directive 86/278/EEC on the protection of the environment, and in particular the soil, when sewage sludge is used in agriculture.** Its objective is to prevent harmful effects in plants, soils, animal and human beings as well as promoting sludge reuse in a safe manner. According to this Directive, sewage sludge must be treated before its agricultural use. It sets limits for heavy metal concentrations in soils; in sewage sludge destined for agricultural use; and for annual amounts of heavy metals added to soils, based upon a ten year average. Likewise, that regulation introduces some operational restrictions for the use of sewage sludge on grazing land or for feedstock crops, on horticultural or fruit crops in contact with the soil which are eaten raw.

The Directive 86/278/EEC is the common regulation of agricultural use of sewage sludge in the EU, although several Member States have already introduced in their national regulations stricter limits for heavy metals, other chemical o microbiological quality requirements, and restrictions in use for specific applications.

At the moment, the European Commission is working in a new text of that regulation. The main newness are (**3rd draft, April 27, 2000**):

- Limit values not only for heavy metals, but also for different groups of persistent organic compounds, such as PCB's, PAH's, Dioxins, etc. It introduces some microbiological criteria for the control of hygienization or stabilization processes.

- Lower thresholds for heavy metals in soil and stricter limits in sewage sludge. In various heavy metals the maximum permitted amount is reduced in a half. Sewage sludge cannot be used in soils whose pH is less than 5.0 on water saturated, flooded or frozen.

- It requires different treatments for sludges depending on the types of land application to be done (like US EPA regulation).

- The responsibility of sewage sludge producers for the quality of sludge supplied and the need of certification.

- Sludges from different industries (pulp and paper, diary products…) are included in the scope of the future Directive.

Another possibility for organic waste (not only sewage sludge) is their composting. In the EU, there are an overabundance of fertilizer regulations, but they only refer to chemical fertilizers (NPK… etc). There is no regulation about organic fertilizers or about compost.

Here, the regulation of the **Eco-label for improvers** in Europe (**Commission Decision 98/488/EU and Commission Decision 12 February 2001**) which establishes the ecological criteria for the award of the Community eco-label to soil improvers should be mentioned. That regulation considers as soil improvers the materials sold as end user products for gardening to be added to the soil to improve at least its physical condition or its physical and biological condition without causing harmful effects.

The criteria are: product source, soil degradation, water pollution, nutrient loadings, safety, nuisance and labeling. Inexplicably, the Eco-label regulation excludes products containing sewage sludge.

Nowadays, the European Commission is working in a proposal (2nd draft) of "***Biological Treatment of Biodegradable Waste"*** for soil application, also known as Composting Directive. That work document includes a comprehensive list of biodegradable residues and has the following objectives:

- The promotion of the biological treatment of organic waste by harmonizing the national measures concerning its management in order to prevent or reduce any negative impact on the environment.

- The protection of soil and the insurance in the use of biowaste results in agricultural benefit.

- The insurance that human, animal and plant health are not affected by the use of biowaste.

The document is in line with the hierarchy principle of the European waste policy. The main aspects in this proposal are the separate collection, composting, anaerobic digestion (biogas recovery), biological treatments and finally use on land. Only treated biowaste is allowed to be spread on land. Subsequently, it establishes the necessary requirements, the producer responsibility and finally the labeling and shipment requirements. High quality standards for compost are required.

The agricultural use or land application of organic waste is considered the best environmental option.

Energy Recovery from waste

One of the possibilities of valorization of organic wastes is its incineration or combustion with energy recovery. We must remember that the thermal destruction without energy recovery is not valorization, it is elimination. Another possibility is anaerobic digestion with energy recovery from the methane produced in that process. Both are sources of renewable energy. The EU Commission underlines the need of suitable Community criteria for waste recovery operations, particularly energy recovery operations, and identifies the importance of criteria concerning the use of waste, in particular as a fuel or other source of energy.

In the field of waste incineration, the EU has approved several Directives: **Council Directives 89/369/EEC and 89/429/EEC on the prevention and reduction of air pollution from municipal waste incineration**

plants and **Council Directive 94/67/EC relative to hazardous waste incineration**. At present, the **Directive 2000/76/EC on the incineration of waste** has regulated together the incineration of municipal waste and hazardous waste. The organic waste is under that legal provision but not all the organic waste. That Directive excludes from its scope the plants that treat only vegetable waste from forestry, agriculture and the food processing industry, wood waste and cork waste.

Its main provisions are limit values of emissions, the need of permit, the operation conditions. The Directive does not impel the energy recovery of waste incineration and that is not in accordance with the waste hierarchy of waste management.

At the moment, the EU Commission is working on **a Proposal for a Directive on the promotion of electricity from renewable energy sources in the internal electricity market** (COM,2000; 279 final). The adoption of this draft Directive is an important part of the Community strategy to further expand the generation of electricity from renewable energy sources in the EU and, therefore, an important step towards the EU's "climate change" Kyoto commitments. The purpose of this Directive is to create a common framework in order to promote an increase of the contribution of renewable energy sources to electricity production. Biomass from agriculture and forestry, vegetable waste from forestry and from the food production industry, untreated wood and cork waste is not included as "renewable energy source". That proposal establishes targets of emissions reductions.

Disposal (Landfill)

In accordance with the waste hierarchy, landfill is the last option for organic waste.

The recent 1999/31/EC Directive, on Landfill of waste, determines stringent operational and technical requirements for waste landfill; it provides measures, procedures and guidance to prevent or reduce negative effects on the environment (pollution of surface water, groundwater, soil and air, greenhouse effect) as well as any resulting risk to human health coming from landfills. This Directive sets ambitious objectives to reduce the amount of biodegradable waste ("any waste that is capable of undergoing anaerobic or aerobic decomposition"), sent to landfill, through separate collection, composting, biogas production or materials / energy recovery and recycling:

- Not later than 2006 reduction to 75% of the total amount of biodegradable municipal waste produced in 1995.

- Not later than 2009 reduction to 50%….

- Not later than 2012 reduction to 35%….

Briefly, the best option for the valorization of organic waste is its agricultural use as a soil amendment, providing that all the regulations direct o indirectly applicable are observed.

IMPLEMENTATION OF EU BIOWASTE POLICY

Biodegradable waste production in the EU

First of all it would be necessary to have a realistic knowledge of the quantity of biowaste produced in the UE but the information available on quantities of waste produced varied according to both sector and country.

Within the term "biodegradable waste" we can consider livestock manures, sewage sludge, organic fraction of municipal solid waste and the residues of some industries (food processing, paper, textiles, wood, etc).
It is a difficult task to estimate the industrial and agricultural quantities of biowaste (waste versus by-products), the variable or unknown water content and the "in situ" recycling operations.

Approximately 65 millions of tones, dry matter, of domestic wastes were produced in the EU (1995), of which 35-50% was biodegradable waste. The estimations of animal manures production are over 154 millions of tones (dry matter), not mentioning Industrial wastes and sludge, green and garden waste, etc…

The quantity of sludge has been increasing greatly in Europe after the implementation of Council Directive 91/271/ECC on urban wastewater treatment. Recent official reports coming from a survey financed by EU results in a production of 7,5 millions of tones (dry matter).

Quality and operational requirements

The reuse and recycling routes of biodegradable wastes shall minimize the adverse effects on the environment. Considering that beneficial reuse of this materials is a priority in the waste policy of the UE, and that the use of biowaste in agriculture should be encouraged, quality requirements immediately arise.
Some of the major risks to be evaluated when organic wastes are applied to land are:

- Potentially Toxic Elements (PTE) and persistent organic pollutants (POPs)
- Nitrogen lixiviating to the ground water contributing to eutrophication
- Pathogens dwelling upon decaying fecal substances

Although sewage sludge represents only a small part of all organic waste used for agricultural land spreading, currently only sewage sludge is regulated by specific legislation (Directive 86/278/ECC). The future sludge directive probably will introduce more strict limits for heavy metals, new requirements for several groups of organic substances and pathogen reduction. All these limits are now under discussion, but they are based more on the prevention principle than in a true risk assessment.

Preventive action should be taken at source, discharges of heavy metals and organic compounds to the sewers must be reduced, considering not only the contribution of industrial wastewater but also those of domestic uses of water, and the contribution of run-off waters.

The current limits for heavy metals set by the Directive 86/278/ECC are indicated in Table 1. It also shows the new limits that probably will be established after its revision. The future Biological Treatment of Biodegradable Waste Directive has the objective of promoting biological treatment of biodegradable waste. This Directive will cover a wider range of organic wastes, promoting its composting and setting high quality requirements for the final product (see Table 1).

Table 1.- Heavy metals limits on organics

	SLUDGE		BIOWASTE		
			2 DRAFT DIRECTIVE BIOWASTE		
HEAVY METALS (mg/kg D.S.)	**DIRECTIVE 86/278/CE**	**3 DRAFT DIRECTIVE**	**Compost Class 1**	**Compost Class 2**	**Stabilised biodegradable waste**
♦ Cd	20 - 40	10	0,7	1,5	5
♦ Cu	1.000 - 1.750	1.000	100	150	600
♦ Ni	300 - 400	300	50	75	150
♦ Pb	750 - 1.200	750	100	150	500
♦ Zn	2.500 - 4.000	2.500	200	400	1.500
♦ Hg	16 - 25	10	0,5	1	5
♦ Cr	-----	1.000	100	150	600

Quality assurance

Both future regulations on sludges and biowaste stress the producer responsibility and quality assurance as key issues. The producer should guarantee the suitability of the product for the intended use and shall implement a quality assurance system for the whole process (production + application). This system shall be independently audited.

Quality assurance necessary will contribute to users acceptance because the producers can present their auditor's report to the people to whom they supply sludges or compost. In this context of quality control of biowaste, the EU Directives also establish information, transparency and record keeping requirements.

Standarization

To monitor the quality of sludges and soils in the EU is essential the development of a series of standardized test methods, as an indispensable tool for ensuring the compliance of the regulations requirements and the comparability of environmental data.

Some Member States have been already implemented national standards that deals with waste characterization or soil quality, sludge quality, but the development of European Standards is the task of the European Committee for Standardization (CEN). According to the rules of procedure, the European standards shall be introduced in the collection of national standards without change.

The work is carried out in technical committees. The CEN TC 308 deals with sludges and is in charge of the elaboration of standards for the analytical characterization of sludges and also codes of good practices for different uses and disposal routes of sludges. It has also prepared a comprehensive report on the current and future utilization of sludges in Europe. Other related committees are TC 223 "Soil Improvers and Growing Media" and TC 292 "Characterization of wastes".

Table 2. Relevant CEN Standards and Technical reports on sludge (Technical Committee 308)

Doc. Number	Title
EN 5667-13	Sampling of sludges
EN 12176	Determination of pH-value of sludges
EN 12879	Determination of the loss on ignition of dry mass
EN 12880	Determination of dry residue and water content
EN 13342	Determination of Kjeldahl nitrogen
EN 13346	Aqua regia extraction for determination of trace elements (h. metals)
EN 12832	Terminology and sludge types
CR 13097	Good practice for sludge use in agriculture
CR 13714	Good practice for sludge production in relation to use or disposal
CR 13846	Recommend. to preserve and extend sludge utilisation and disposal routes
Work in progress	
Chemical analysis	Phosphorus, Organic carbon, NO_3 nitrogen, NH_4 nitrogen, AOX, PCB
Physical analysis	Capillary suction time, calorific value, settletibility, resistance to filtration, compressibility, centrifugability
Biological analysis	Escherichia coli, Salmonella
Codes of Good Practice	Land reclamation, incineration, sludge drying, landfill

Sustainable biowaste management in the EU

EU policy on waste and its legislative framework is highly protective for environment, enforces separate collection and promotes biowaste recycling as a priority action in the way towards a sustainable society.

General objectives for a sustainable biowaste management are:

- Public participation and acceptance.
- Moderate Investments and Operational costs
- Codes of good practices in the whole production and recycling process.
- Social voluntary agreements including the different parts involved: (Safe Sludge Matrix (UK), Swedish farmers and Sludge producers (Sweden), National Biosolids Partnership (USA)

The role of services companies

Waste management and recycling companies have a key role for achieving this objective, further on the implementation and compliance of legislation, but also to attain sustainable biowaste recycling operations at reasonable costs through different actions:

- Independent Consultancy and Basic Engineering in the first project stages
- Independent Technology selection in the context of any client reality
- Development of Public-Private teams and partnership for excellence in management
- Marketing expertise for final products (compost…) to avoid "compost hills"
- Imagination, Initiative and Flexibility for designing and building the future "Integrated Waste Recycling Facilities: Ecoparks"

A critical view of EU policy on biowaste

There are still some gaps in EU policy and legislation on waste, from the manager perspective:

- Still there are very different national and regional legislations and national policies on waste. (E.g. 19 different regulations in 15 EU countries relatives to sewage sludge utilization)

- Lack of a common frame for all the biowaste management and recycling:

  - Big differences in quality standards between 3rd draft Sludge Dir. and 2nd draft Biowaste Dir.

  - Too strict pollutants limits (even lowest than soil background concentration).

  - Lack of consideration of Alkaline Stabilization, Thermal Drying and other "non biological technologies" in 2nd draft Biowaste Directive

- Difficulties for Wastewater operators (legal and administrative), to control or enforce pollutants control at source.