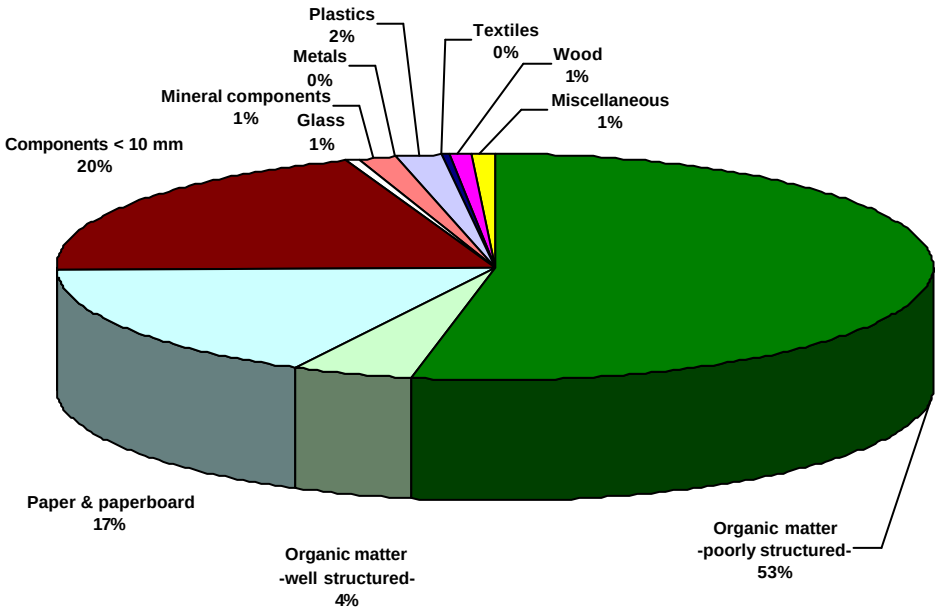
Collection and compostion of source separated biowaste in different settings in Germany

In Germany, source separation of organic residues from households, gardens and parks (=biowaste) has become a well established waste management activity. As of the latest statistics about 7 million tons are collected separately. The whole potential of organic raw material amounts up to 9 million tons. From the 419 waste management authorities about 330 (79 %) have introduced the separate collection of biowaste from households within their jurisdiction. This gives a coverage of the total population by separate biowaste collection of about 70 %. The participation of the households in the areas with a collection of source separated biowaste is 54 % in average with a range of 43-81 % depending on the region. Mainly, households are provided wheelie bins with volumes between 80-360 litres for their source separated biowaste. Usually, these bins are collected from the curbside in a two weekly rhythm. Other receptacles used for the separate collection of biodegradable waste are special plastic sacks, mainly these are for green and garden waste (e.g. green cut, leaves), however. The specific amount of separately collected biowaste is 60 kg/cap*a in average (ranging from 23 to 182 kg/cap.*a) and 20 kg/cap.*a for garden waste. The greatest potential in the collection of source separated biowaste lies in the improvement of the collected quality (content of impurities) and increase of the amount, i.e. increase of participation rate. Experts believe that the participation rate can be increased to an average level of 74 %. As the most important measure they quote differentiated waste fee systems and public information and awareness raising activities. The results of sorting campaigns are among others used as an indicator for the development of the waste streams and effectiveness of the applied measures (e.g. shifting material proportions and share of impurities). In Germany, the separate collection of biowaste is usually accompanied by the collection of other recyclable materials and residual waste and part of a general collection system for source separated waste (e.g. glass, waste paper, packaging waste). The applied collection scheme and quality of the collected biowaste are very much interrelated.

Composition of Source Separated Biowaste

(Results of a concerted sorting campaign in three municipalities in the West of Germany)

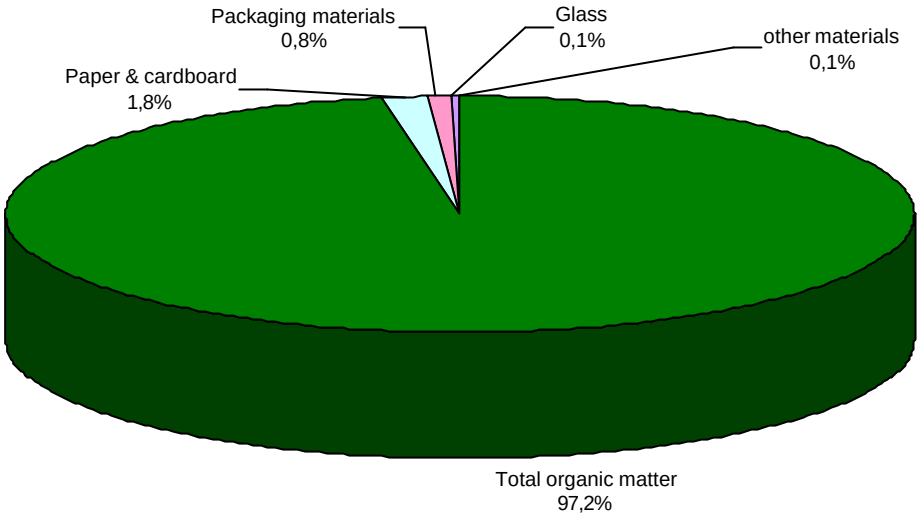


The results of the above campaign between 1999 and 2003 showed marginal differences between the quality of the source separated biowaste collected from urban and rural areas.

Another camapaign conducted between 1996-1998 in a metropolitan area (mainly large housing estates and multistorey residentail budings) in the East of Germany gave the following picture.

Composition of source separated biowaste

(Results of a sorting campaign in an urban area in the East of Germany)



Both illustrations confirm the impression that with an adapted system for the separate collection and an appropriate framework (differentiated waste charging, law enforcement and accompanying measures, i.e. public education) a very good quality of source separated biowaste can be achieved across differing urban structural settings.

Project experiences that have been made, among others also by the author in Syria, showed that introducing a separate collection of biowaste in developing countries can be feasible and successfully realised with a proper preparation and appropriate measures for the early information of all parties involved. It has however to be clear that the collection of biowaste in countries with tropical climate and yet less developed infrastructure always poses a particular challenge with regard to collection organisation and logistics.

Pict. 1: Specially marked sack for the separate biowaste collection in Syria

Pict. 2: Collection of source separated biowaste (green sack) and residual waste in Syria

The source separation of organic waste leads to significant differences in the further processing of this waste and outcome.

Outcome obtained from the composting of different waste input

Aside from large amounts of organic material, municipal waste streams anywhere in the world do contain increasing quantities of glass, plastics, metals and hazardous materials. These materials would not only mean an unwanted pollution of recycled organic matter but thru the potential to contaminate the organic product with noxious substances such as concentrations of salts and heavy metal minimise its utilisation potential dramatically. That's why these materials need to be separated from the organic fraction before composting. Separating these contaminants after collection is quite an expensive option since it requires additional effort, space, and time, moreover it is likely that much of the contamination has already affected the organic fraction. Source separating the waste before collection is therefore the best way to ensure a good compost quality. It also alleviates the processing and process handling, and results in a higher safety from operational break-downs and damages on the equipment required for large-scale composting.

Worldwide investigations done for different composting schemes showed that a feedstock of source separated biowaste is the best assurance for a good and consistent compost quality. What is of particular importance is that carrier substances of hazardous material and heavy metals such as electronic components, composites or batteries can be largely excluded in this way from reaching the plant or contaminating the organic fraction in the course of collecting, transporting or processing the waste. Heavy metals are present as soluble or non-soluble anorganic salts or organically fixed. Opposite to disturbing materials which retain an inert character, they are included into the transformation process and can be directly incorporated into biomass or become part of the end product in metabolised form. To remove harmful organic substances and most of the heavy metals from the input by technical means is largely impossible, however.

In support of this ascertainment the following tables shall be presented. They summarise the results of various investigations on the heavy metal concentrations in different waste derived composts and underline that source separated biowaste produce a higher quality end product compared to non-source separated municipal solid waste regardless of the technological processes applied.

Tab. 1

Heavy metal	Source separated MSW compost Europe and North America	Source separated MSW compost Java Indonesia	Non-source separated SWM compost Netherlands	**Proposed Standards for Developing countries**
Arsenic	0	5	0	**10**
Cadmium	1.2	9.0	7.3	**3**
Chromium	27	20.0	164.0	**50**
Copper	15	54.0	608.0	**80**
Lead	86	99.0	835.0	**150**
Mercury	0.9	0.9	2.9	**1**
Nickel	17.0	50.0	173.0	**50**
Zinc	287.0	236.0	1567.0	**300**

(World Bank, 1997a)

Tab. 2: Effects of the source separation of biowaste on the compost quality in Germany

	Composts from mixed municipal waste[1] (former standard in Germany)	**Composts from source separated biowaste**[2] (present standard in Germany)	**Home-made garden composts**[3]
Pb	513	46.4	40-60
Cd	5.5	0.47	0.3-0.6
Cr	71.4	25.3	25-40
Cu	274	57.7	40-60
Ni	44.9	16.3	15-25
Hg	n.a.	0.16	0.1-0.2
Zn	1,570	203	180-240

[1] LAGA Information no. 8, Sheet M 10, State of October 1984
[2] Average values for Germany according to the study of UBA/BGK, 2003
[3] Range of frequently measured values in Germany

Tab. 3: Results from the compost analysis in a pilot on waste composting in Syria

Heavy metal concentrations		**Samples of compost generated from**			
		Mixed household waste		**Organic material obtained from the mechanical pre-treatment of MSW**	**Source separated biowaste**
		#1	**#2**	**#3**	**#4**
Pb	mg/kg	117	118	122	117
Cd	mg/kg	0,1	0,1	0,2	0,1
Cr	mg/kg	0	0	0	0
Cu	mg/kg	96	72	87	65
Ni	mg/kg	56	49	34	26
Hg	mg/kg	2,3	2,1	1,9	0,89
Zn	mg/kg	456	324	214	159

Proposed standards for organic matter obtained from waste composting

In response to the different approaches used to recycle the biodegradable fraction of the municipal waste by the way of composting, the differing qualities of the compost product arising thereof and the considerable impact of noxious substances contained in the compost to the soil, the atmosphere and the ground water resources, many countries have meanwhile released regulations that govern the use of the compost product and prescribe the maximum allowed concentrations of potentially harmful substances.

The follwing tables give an overview on such standards.

Global compost standards as of April 1996

Country	As	Cd	Cr	Cu	Pb	Hg	Ni	Zn
				(mg/kg dried matter)				
USA(S)	41	39	1200	1500	300	17	420	2800
Canada (MO)	13	2.6	210	128	83	0.83	32	315
Ontario (SSMO)	10	3	50	60	150	0.15	60	500
Austria (MO)	--	4	150	400	500	4	100	1000
Belgium (SSMO)	--	1	70	90	120	0.7	20	280
Denmark -	--	1.2	--	--	120	1.2	45	--
France (MO)	--	8	--	--	800	8	200	--
Switzerland	--	3	150	150	150	3	50	--
Spain	--	40	750	1750	1200	25	400	4000
Indonesia (proposed)	10	3	50	80	150	1	50	300

(S) refers to sewage sludge, (MO) refers to mixed organics, (SSMO) refers to source-separated mixed organics, (proposed) refers to standards proposed by the World Bank-suggested for all developing countries as a good starting point. (World Bank, 1997a).

Standards for the compost production in Germany as compared to Syrian guidelines

Allowed total concentrations on heavy metals	***Bundesgütegemeinschaft Kompost in Deutschland*** *(Federal Association for Compost quality in Germany, BGK)*	***Syrian Guideline for compost production*** *(state of 1999)*	
(mg/kg)	*Related to 30% dry matter*	*1st quality*	*2nd quality*
Pb	150	120	150
Cd	1.5	3	5
Cu	100	150	250
Cr	100	100	150
Ni	50	50	70
Hg	1	1.5	3
Zn	400	350	500
As		15	25