Germ emissions in the collecting bins for tailings and waste materials 1998

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Date of Publication: June 1998

1. Summary

In the present study, the fact that germ emissions might expose the user of the three different bins (bin for "bio-waste", bin for tailings and bin for compound and packaging material = "light fraction") to health risks could not be evidenced. However, the health of waste collectors may be at risk because they are not only exposed to aerosols sporadically but throughout their working hours. In this respect, further studies in the field of occupational medicine would be necessary. At any rate, the recommendation not to send persons suffering from immunodeficiency to bins for "bio-waste" must be upheld. Annoyance by bad smell is no health risk. Still the prescribed one-week collecting intervals should be kept, above all in summer.

2. Starting Position

Since the novel of the Styrian Waste Management Act in 1990, the separate collection of "bio-waste" has been prescribed. As "bio-waste" consists of organic kitchen and garden waste, mould fungi, bacteria and other microorganisms participating in rotting will already be multiplied in the bin for "bio-waste". The resulting smell emissions has led to the discussion of possible health risks caused by airborne microorganisms.

Sites	Volume of the Bin		
	Bio-Waste	Tailings	Light Fraction
Site: **P**	240 litres	1,100 litres	240 litres
Site: **S**	240 litres	1,100 litres	1,100 litres
Site: **A**	240 litres	240 litres	1,100 litres

Table: Measuring places and collecting bins

3. Goals

The present study was aimed at acquiring the average germ density of culturable bacteriae and mycelium forming fungi (=mould fungi), of Aspergillus fumigatus as well as of thermophile actinomycetes and bacillae in the ambient air surrounding collecting bins for waste and waste material. In this context, it was, above all, a question of measuring the emissions during the opening of the three different bins (bin for "bio-waste", bin for tailings and bin for compound and packaging material = "light fraction") in order to be able to estimate possible health risks for the user and give recommendations for the emptying rhythm.

4. Procedure

From February to June 1998, air germ measurements were made in two weeks' intervals in the area of collecting facilities for "bio-waste", tailings and compound and packaging material ("light fraction") at three different sites in Graz. The measuring instruments used were two 6-step Andersen Cascade Impactors. The measuring time amounted to two minutes each time, which corresponds to an air intake volume of 56.6 litres. At each site, the ambient air of the individual collecting bins was measured in the first measuring cycle by opening and closing the bins several times. The measurements were made about 20 cm above the rim of the bin. In addition, the parameters temperature of the surrounding air and the filling state of the bins were determined.
The incubation temperature was as follows
for bacteriae as well as for Aspergillus fumigatus 37°C,
for mould fungi 25°C,
for thermophile bacteriae (actinomycetes and bacillae) 50°C.
The total number of colonies of bacteriae and Aspergillus fumigatus was counted after 48 hours, that of mould fungi and thermophile bacteriae after 7-10 days. Selected colonies of thermophile actinomycetes were transferred to the differentiating media glucose-yeast extract-malt extract pepton agar (GYMP), glucose-yeast extract-malt extract agar (GYM) and standard-I-malt agar (StIM).

5. Result / Benefits

In principle an increase in the number of germs in the ambient air may be expected when bins for waste and waste materials are opened and closed. For the three sites, the following numbers of air germs (mean values) were determined during the eight measuring days:

Bacteriae: between 44 and 221 KBE/m^3 air (minimum 0 KBE/ m^3 and maximum 1.225 KBE/m^3).

Thermophile actinomycetes: 0 KBE/ m^3 (minimum 0 KBE/ m^3 and maximum 35 KBE/ m^3).

Thermophile bacillae: between 0 and 80 KBE/ m^3 (minimum 0 KBE/ m^3 and maximum 124 KBE/ m^3).

Mould fungi (mainly Cladosporium sp., Alternaria and Penicillium sp.) numbers of germs (mean value) between 460 and 1.034 KBE/ m^3 (minimum 35 KBE/ m^3 and maximum 10.726 KBE/ m^3) and for

Aspergillius fumigatus between 0 and 18 KBE/ m^3 (minimum 0 KBE/ m^3 and maximum 141 KBE/ m^3).

Numbers of Germs (KBE/m^3 air)

Sites	Thermophile actinomycetes			Thermophile bacillae			Bacteriae			Mould fungi			Apergillus fumigatus		
Site P	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Ambient air	0	18	0	0	35	18	0	300	53	124	3958	725	0	88	18
Bin bio-waste	0	0	0	0	35	9	0	247	106	495	5018	840	0	141	0
Bin tailings	0	35	0	0	18	0	0	247	88	124	6308	822	0	71	9
Light fraction	0	18	0	0	18	0	0	194	71	159	4718	892	0	124	0
Site S	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Ambient air	0	18	0	0	0	0	18	141	88	88	1997	707	0	53	9
Bin bio-waste	0	18	0	0	53	0	0	124	44	106	3993	636	0	53	18
Bin tailings	0	0	0	0	53	0	0	901	80	35	10726	707	0	71	0

Light fraction	0	18	0	0	53	9	0	424	53	106	3852	654	0	18	0
Site A	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Ambient air	0	0	0	0	88	9	0	724	71	35	3463	875	0	53	0
Bin bio-waste	0	18	0	0	124	80	35	1255	168	124	2668	1034	0	53	0
Bin tailings	0	18	0	0	124	27	18	601	106	88	2562	680	0	88	9
Light fraction	0	18	0	0	35	9	18	795	221	71	1484	460	0	35	0

Table: Results of the air germ measurements in the area of the different collecting bins for waste and waste material at three different sites in Graz (all data in KBE/m3), n= 8 measuring days

A comparison of the individual waste fractions showed that bacteriae, mould fungi, Aspergillius fumigatus and thermophile actinomycetes were emitted by each fraction to the same extent. Only for the group of the thermophile bacillae was the emission due to the bin for "bio-waste" was significantly higher.
The filling state had no impact on the number of the air germs emitted in any fraction. Bidingmaier et al. and Martens et al. have shown in their studies that the emission of fungus spores was only slightly higher after a dwell time of 14 days than after 7 days. As, however, the composition of types will change at a longer dwell time, the quality of the germ emission might change. What seems more important is to consider the effects of longer dwell times in relation to annoyance caused by bad smell and the attraction of pests and the influence of larvae.

In order to avoid that the population refuses the collection of "bio-waste" for hygienic-aesthetic reasons, it is recommended to keep a one-week collecting interval during the summer months. The results of the present study show that the growth of bacteriae, mould fungi, thermophile actinomycetes and Aspergillus fumigatus is independent from the waste fraction (bio-waste, tailings and light fraction). Only for thermophile bacillae is it shown that the emission was mainly caused by the bin for "bio-waste".
In the present study, a very low correlation between outdoor temperature and germ growth (0.28 or 0.21 at p=0.01) was observed for bacteriae and mould fungi in the investigating period (bivariate correlation according to Pearson). For bacillae and Aspergillius fumigatus, no correlation could be established. This is due to the fact that the mean ambient temperature during the investigating period amounted to 14°C. A distinct correlation would only become visible at higher temperatures.

It may be excluded that germ emissions as they have been evidenced in the present study endanger the health of the user. Even a higher germ emission, which may occur in summer, does not expose the population to any danger because the germ cloud in the outdoor air will be diluted very quickly and the inhaled quantity of germs is very low because the breathing time volume of 6 litres a minute is very low.