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Development of exhaust air treatment in animal husbandry in Germany

The number of exhaust air treatment installations built in Germany accumulated from 1997 to 2010 to 1014, as producer inquiries showed. In this connection 762 installations were allotted to pig housing, 170 to poultry housing and 82 to other applications. In pig housing predominantly approved exhaust air treatment installations were used. The market share, related to the number of installations, for bio filters, trickle bed filters and multistage operations amounted to 26.4, 24.0 and 43.2 % in 2010. In poultry housing approved exhaust air treatment installations were scarcely used so far. In this respect conclusions are neither possible concerning the process technique nor their effectivity. Growing environmental regulations and growing opposition by local communities for larger pig and poultry husbandries will result in marginal development perspectives in future without using approved exhaust air treatment installations.

Keywords
Exhaust air treatment, animal husbandry, bio filter, trickle bed filters, multistage installations

Abstract
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The Institute of Agrotechnology and Biosystems Engineering of the Johann-Heinrich von Thünen Institute (formerly Federal Agricultural Research Centre, FAL) makes inquiries among producers of exhaust air treatment techniques for many years. In 2006 and 2007 eight producers were consulted [1]. Four of them were approved on the basis of the "Cloppenburger Leitfaden" or the DLG test frame "Abluftreinigungssysteme für Tierhaltungsanlagen" [2]. The inquiry was repeated in 2010. In the meantime 12 producers could be consulted. Eight of these producers dispose of an approved technology. All of these companies have provided extensive and thus evaluable information in this inquiry. Only one answer is available from the four producers without an approval.

At first the producers were asked for the number of their installed facilities in mentioned years, divided into pig and poultry keeping and other applications as well. After this the number of installed facilities should be differentiated into animal specific size ranges by a given pattern.

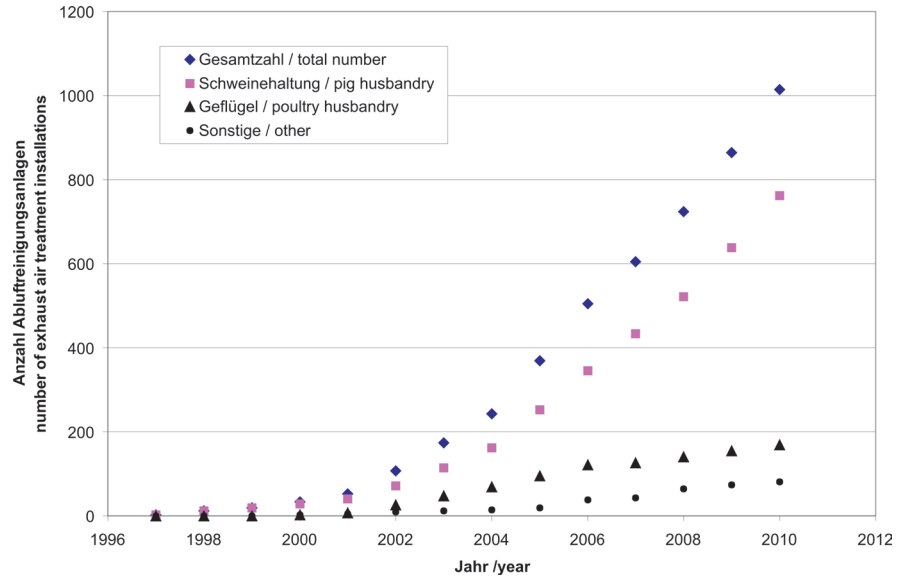
Results

The number of exhaust air treatment facilities in German husbandry clearly increased in recent years (**figure 1**). Based on evaluated producer information a total number of 1014 installations were built between 1997 and end of 2010. 762 of it were installed for pig, 170 for poultry houses and 82 for other applications (biogas plants, digestate drying and slaughter houses). It is conspicuous that the number of exhaust air treatment installations for pig houses is still increasing with 125 only in 2010, whereas the increase in poultry housing is only moderate with 15 installations.

Based on evaluated producer information all in all 368 exhaust air treatment installations for fattening pig houses were built between 2006 and 2010 t**able 1**). The number of annually installed facilities increased from 65 (2006) to 89 (2010). Exhaust air treatment installations were built for all requested size ranges, although 53 % of it fell upon ranges between 400 and 1500 fatteners. For farms with more than 1000 and 2000 heads respectively an increased use of exhaust air treatment installations becomes noticeable. But there is no change for farms with less than 400 heads.

Between 2006 and 2010 all in all 77 exhaust air treatment installations were built for the single piglet production (**table 2**). The number of annually installed facilities increased from 11 (2006) to 20 (2010). They were installed for nearly all requested size ranges, although 74 % of it fell upon size ranges between 1000 and 4000 piglets.

Fig. 1



Cumulative development of exhaust air treatment installations in animal husbandry in Germany

Table 1

Temporal development of exhaust air treatment installations in pig fattening; subdivided into different stock sizes

Jahr *Year*	Anzahl Mastschweineplätze *Number of fattening pig places*							Summe *Sum*
	< 100	< 400	< 1000	> 1000	> 1500	> 2000	> 5000	
2006	2	10	20	13	11	6	3	65
2007	2	7	24	17	11	4	0	65
2008	3	6	24	18	5	11	0	67
2009	0	10	18	17	17	17	3	82
2010	1	8	22	24	15	16	3	89
Summe *Sum*	**8**	**41**	**108**	**89**	**59**	**54**	**9**	**368**

Table 2

Temporal development of exhaust air treatment installations in piglet houses; subdivided into different stock sizes

Jahr *Year*	Anzahl Ferkelplätze *Number of piglet places*						Summe *Sum*
	< 500	< 1000	< 2000	< 4000	< 6000	> 6000	
2006	1	3	2	3	0	2	11
2007	0	3	0	6	0	2	11
2008	0	2	3	3	0	0	8
2009	0	3	19	5	0	0	27
2010	3	0	8	8	0	1	20
Summe *Sum*	**4**	**11**	**32**	**25**	**0**	**5**	**77**

For layer houses 26 installations were built between 2006 and 2010 on the basis of producer information (**table 3**). As shown in **table 3**, since 2008 waste air treatment installations were predominantly built for stables with more than 42 000 heads. None of these installations is approved on the basis of the "Cloppenburger Leitfaden" or the DLG test frame. Exhaust air treatment facilities for layer houses are offered only by few producers contrary to those for pig houses.

Table 3

Temporal development of exhaust air treatment installations in layer houses; subdivided into different stock sizes

Jahr *Year*	Anzahl Legehennenplätze *Number of layer places*						Summe *Sum*
	< 5 000	< 10 000	< 15 000	> 15 000	> 30 000	> 42 000	
2006	0	0	2	3	0	0	5
2007	0	0	0	2	0	0	2
2008	0	0	0	1	0	6	7
2009	0	0	1	1	1	5	8
2010	0	0	0	0	0	4	4
Summe *Sum*	**0**	**0**	**3**	**7**	**1**	**15**	**26**

Table 4

Temporal development of exhaust air treatment installations in fattening houses for broiler and ducks; subdivided into different stock sizes

Jahr *Year*	Anzahl Masthähnchenplätze und -entenplätze *Number of broiler and duck places*						Summe *Sum*
	< 10 000	< 20 000	< 30 000	> 30 000	> 50 000	> 84 000	
2006	0	0	0	24	0	0	24
2007	0	0	0	5	0	5	10
2008	0	0	0	0	0	6	6
2009	0	1	1	5	0	0	7
2010	0	0	0	10	1	0	11
Summe *Sum*	**0**	**1**	**1**	**44**	**1**	**11**	**58**

Based on producer information 58 installations were built for broilers between 2006 and 2010 (**table 4**). More than 96 % of it was constructed for houses with more than 30 000 heads. All installations which had been built before 2010 did neither dispose of an approval by the "Cloppenburger Leitfaden" nor by the DLG test frame. Since August 2010 a DLG approved process is available for broilers kept over 35 days at maximum. However, this process is only approved for reduction of particulate matter and ammonia. It is not suited for odour reduction [3].

Based on producer information all in all 125 exhaust air treatment installations were built for pig houses in 2010, while it were 89 in 2005 and 30 in 2002 (**figure 2**). The relative portion of trickle bed filters increased almost linearly from 0 % in 2001 to 24 % in 2010. Single stage bio filters achieved their highest market share about 80 % in 2000 and 2001 and their lowest about 17.5 % in 2003. In 2010 the market share of single stage bio filters was 26.4 % again.

Multistage operations had their highest market share with 65–77.5 % in the years 2003 to 2006. Since 2006 it decreased continuously to 43.2 % (2010).

On basis of producer information and as shown in **figure 3**, 61.5 % of the installed single stage bio filters have been constructed for fattening pig farms below 1 000 heads. Merely 11.5 % were built for facilities with more than 1 500 heads.

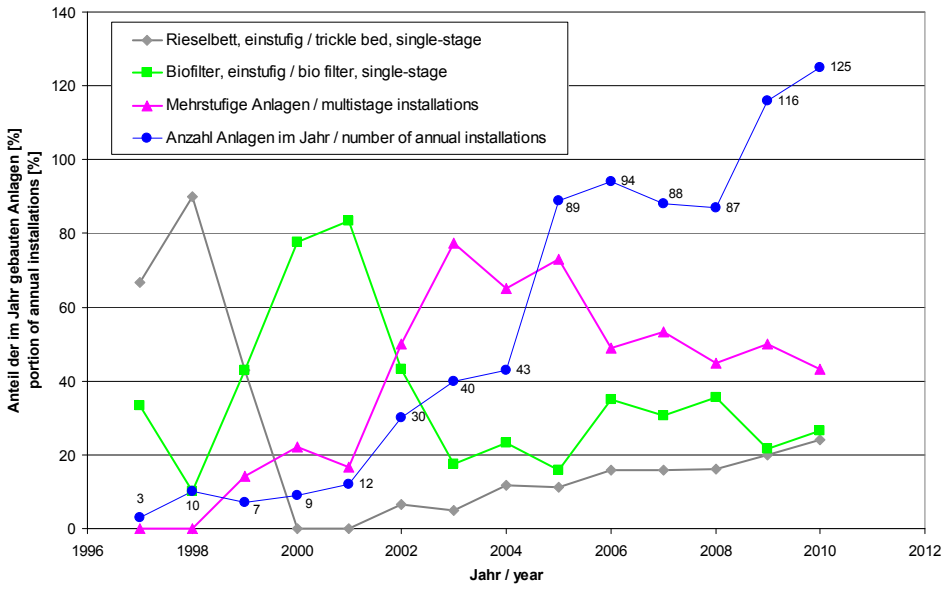
53.9 % of the trickling filters were built for stock sizes of less than 1 500 heads. But also for big stock sizes with more than 1 500 heads trickling filters were constructed (38.4 % of all trickling filters).

In contrast only 7.7 % of the multistage facilities were built for farms with less than 1 000 heads. More than 80 % of it fell upon farms with more than 1 500 fatteners.

Conclusions

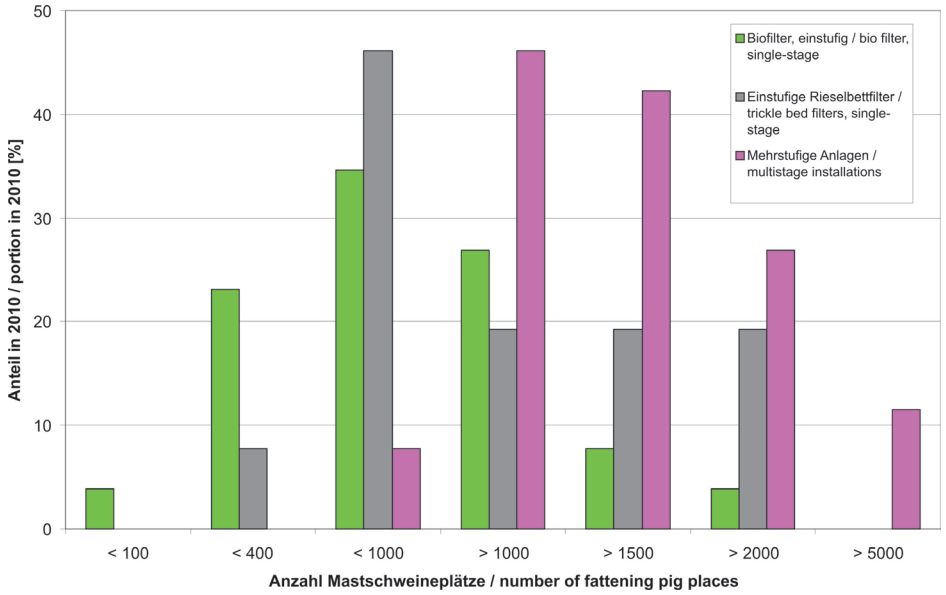
Based on producer information all in all 1 014 exhaust air treatment installations were built in Germany between 1997 and 2010. 762 installations fell upon pig housing, 170 on poultry housing and 82 installations on other applications as well (biogas plants, drying of digestate drying, housing of calves). The portion of multistage installations in pig housing was 43.2 % in 2010. Their market share is declining since 2003. Single stage bio filters had a relatively constant market share about 26.4 % in this segment in 2010. For single stage trickling filters it was 24 %, but with an increasing tendency. Multistage operations were predominantly built for big pig housings with more than 1 500 heads in 2010, while single stage bio filters were used for stock sizes below 1 000 heads (61.5 % of all single stage bio filters). Trickling filters are used for livestock sizes below 1 000 heads (53.9 %) and for livestock sizes of more than 1 500 heads as well (38.4 % of all trickling filters).

Fig. 2



Relative development of different exhaust air treatment systems in pig housing

Fig. 3



Relevance of different exhaust air treatment systems against number of fattening pig places

The number of exhaust air treatment installations in pig housing will continue to increase due to tightened environmental conditions (bio aerosols) and technical improvements (reduction of costs).Multistage operations will be dominant for big farms and single stage bio filters for farms with less than 1 000 heads. Trickling filters will gain in importance due to their broad application possibilities.

Exhaust air treatment installations will also become more important in poultry housing. Up to now installations are used which predominantly did not dispose of an approval. Therefore reliable assessments on their efficiency are merely possible. In face of increasing resistance to big poultry houses without exhaust air treatment improvements are conceivable in this field.

Literature

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