Edith Szabo, Ines Schäfer and Wolfgang Büscher, Bonn

Dust Exposure of Bedding Material in Horse Keeping

In horse keeping bedding material is a main source of high dust emissions. Especially straw, which is frequently used, causes respiratory diseases. Alternative bedding material might be the solution. At the Institute of Agricultural Engineering of Bonn University a standard procedure was developed, where six different bedding materials were examined on their dust emissions, dependent on particle size during littering.

Edith Szabo is veterinarian and postgraduate student, cand. Ing. agr. Ines Schäfer is student assistant and Prof. Dr. Wolfgang Büscher is the institute head and head of the „Livestock Technology" section at the Institute for Agricultural Engineering of Bonn University, Nussallee 5, 53115 Bonn, Germany; e-mail: *edith.szabo@uni-bonn.de*

Keywords

Dust, bedding material, copo, stable air

Material and methods

Bedding material

The analysed materials are all current in horse management systems: straw, wood shavings, flex, hemp and pellets of chopped straw. Miscanthus as the sixth sample is an innovation and alternative to other types of bedding. It has the advantage of reduced dust release and thus results in a lower irritation of the respiratory tracts. Straw as the most common bedding material in horse management systems has been taken from round bales for this research, which were baled in summer 2003 under dry conditions. The other materials were packed in conventional bales, which are available in specialised trades. Except straw, all bales were advertised as „dust-free" or „dedusted". The aim of the following experiments is to analyse the difference between straw and alternative materials concerning their dust release.

Execution of the test and sampling technique

To avoid external influences as horse activity or the climate within the stable, a laboratory environment was used for testing the six different bedding materials. For simulation of bringing out the bedding in the box we constructed a wooden cube which is centrically rotated. The rotating velocity of the box is 9 min^{-1} and realised by an electric motor (*Fig.1*). The movement of the probes simulates an extreme interspersing of bedding in a horse box. Dust particles are easily charged electrically when brought in motion and inhere on the surface of the cube. The consequence is a falsification of measured data. Therefore the cube was lined with aluminium foil. The front surface of the box, which can be opened for loading, is made of aluminium. The radial symmetric measurement head of the dust sampler can be inducted by a lateral small opening towards the centre of the cube, without opening the whole frontside.

The samples were weighed before each measurement and 100 g were brought in the middle of the box. Four samples of each bedding material were analysed by rotating them for one minute in the cube. The measurement started subsequent to the rotation one minute in the box. Efficient cleaning of the cube should guarantee a ìdust-freeî initial situation. As we know this is nearly impossible, the background dust concentration was measured two minutes before loading the cube and subtracted from the dust concentration of each sample. Thus there were always the same conditions before each measurement.

Dust particles were counted with a aerosol spectrometer 1.108 produced by Grimm company, Ainring. Dust particles were measured depending on the particle size by a light scattering method. The particles are classified in 15 different sizes, from 0,3 µm up to >20,0 µm.

Results

Instead of indicating the absolute values, the dust concentration of each bedding material is presented in correlation to the dust concentration generated by straw in percent. Because of very high dust concentrations, the smallest particles were out off the measurement range. Consequently only the particles

Bild 1: Rotierender Würfel zur Staubmessung

Fig.1: Rotating cube for dust monitoring

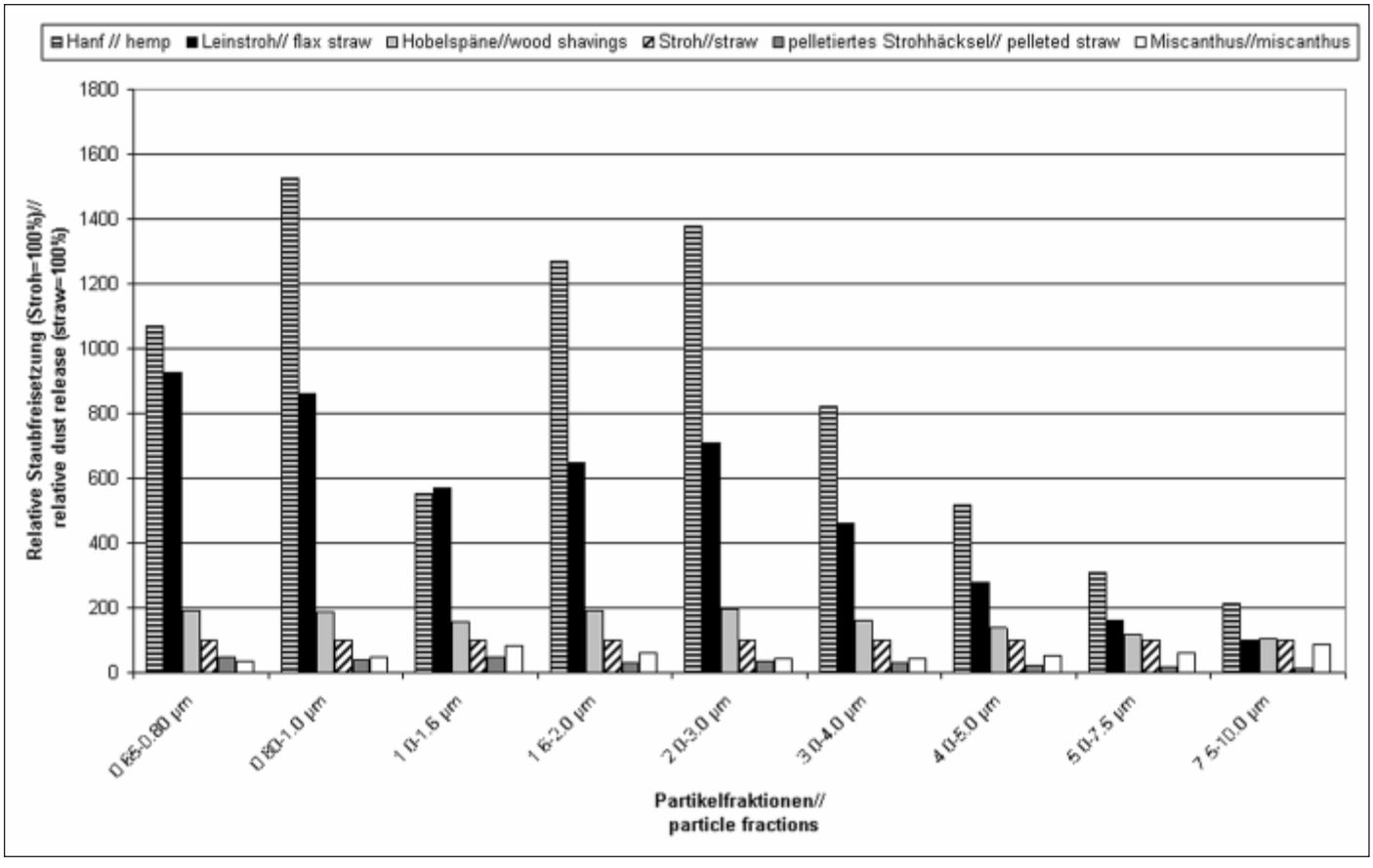

Fig. 2: Dust formation of different bedding sources in relation to straw

between 0.65 and 10.0 µm were taken into consideration, to avoid a measurement error. As can be seen in *figure 2*, hemp shows the highest dust release. Compared to straw, the values are 10 - 15 times higher. Similar studies by the Bergische Universität Wuppertal confirm these results.

Differing from references, flax could not rank among material with reduced dust generation. Close to the measured values of hemp, especially small particles show a 5-9 time higher dust release as straw.

Pelleted material distinguishes through a very low dust concentration. Particularly the pelleted straw was classified as „less dusty", as investigations in practice confirm so far.

Wood shavings, one of the most frequent bedding material used in horse stables after straw, shows in all sizes 1-2 times higher concentration compared to straw.

Conclusion

The intention of this experiment was the comparison of different types of bedding material by using a standardised method. Previous investigations at the Institute of Livestock Technology of the University Bonn confirmed, that hemp also caused the highest dust concentration. These test series do not consider the development of bedding material in a box in the course of time, when the bedding accumulates. It is possible, that wet material has completely different characteristics, compared to the dry samples. Currently undertaken test series in practice are supposed to explain these and similar interrelations.

Literature

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