USAGE OF PLASTIC LITTER MADE FROM SEPARATED SLURRY IN FARM ANIMAL BREEDINGS ESPECIALLY IN CATTLE

FOLOSIREA DE ŞEÆURILOR DIN MATERIAL PLASTIC REZULTATE DIN SEPARAREA PURINULUI PROVENIT DIN FERMELE DE CREŞTERE A TAURINELOR

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The observation was performed in two dairy cows’ herds of Holstein breeding stabled in brick buildings with loose box stabling system. The separated slurry was used as litter in one of the building, classical stabling regime with straw litter was used in the other one. The experiment ascertained a significant tendency to reduction of microorganisms and parasites quantity in separated slurry modified by biometric treatment through the method of managed composting process. There was quite a small quantity of microorganisms and parasites in samples taken from litter of separated slurry and only after three weeks a gradual proliferation of them began. From the viewpoint of the dairy cows’ state of health, the quantity and quality of their milk production, the cleanness of their body surface, the periods of their lying and other ascertained welfare parameters under given microclimatic conditions the application of separated slurry as plastic litter fully complied.

Keywords: separated slurry, plastic litter, dairy cows, health, ethology

Introduction

The bedding material and its maintenance are important factors influencing quality of environment of stabled animals. Proper choice and care of bedding will manifest cleanness of animals, quantity of injuries and also incidence of diseases. Generally, there are used different organic and inorganic materials with all their advantages and disadvantages as litter. In our conditions we use most often straw, which is easily available, cheap, absorbs humidity well, has good insulating
properties and can be further processed. With respect to the increasing lack of this conventional material on most of the farms, it is necessary to search appropriate litter material with good plasticity allowing soft imitating of the body surface of the animal lying down against the rough bottom of the stable floor. This material should also have good insulating properties.

One of the convenient media is for instance the separate of the beef slurry with a high portion of dry matter specially converted for the demands of bedding in the boxes. The first (for the present unofficial) experiments with the usage of this bedding materials where performed in the Czech Republic and abroad, too. The separate of the beef slurry begins to be promoted as one of the options of bedding material in the diary farming. It is used with success on some farms in the south-west of the United States and in Europe it was extended for example in Italy, in the regions characterised by dry and warm climate during most of the year. According to results published up to now, the welfare of the stabled animals improves by the usage of this litter (CATANZARO, 2000; HEMSWORTH P. H., COLEMAN, G. J., 1998). The cows form their own natural bed in the plastic organic material, so that their body cannot get cold during lying on the bare floor. Handling this slurry separate is very simple, because the slurry is not thrown out of the stabling area. The cleanliness of the animal body surface improved markedly.

However, the utilization of the native slurry separate is from the veterinary viewpoint not fully trouble-free. The main potential risk is the epizootological and epidemiological factor, coming out of the fact that microbial contaminated animal excrements return after some physical preparation to environment of their origin. Mixture of solid and liquid excrements is a customary bearer of varied spectrum of microbial agents and simultaneously their proliferating medium. It is not possible to ignore the possibility of an immediate transmission of optional pathogenic strains as well as appropriate agents of serious animal infections of bacterial, virus, mycotic and parasitic origin that are very often transferable also to humans.

This just mentioned risk can be not only epizootological, but also epidemiological one, because this stabling environment, modulated in such a way, is simultaneously the manufacturing space for food production – i.e. milk and meat for the human consumption. To the previous aspects also the aspects of food hygiene can be assigned, especially the hygiene of food of animal origin acquired in such environment. It means to suppress the dispositions to proliferation and expansion of undesirable and risk microorganisms, preferably by the nonresidual forms and means and without use of totally sterilizing methods. The implementation of the contemplated technology of slurry recycling in the form of separate supposes the condition of the fractional warming up of this material as the basal maturing period with a sufficiently long action thermal exposition in the final phase. This process must reliably devitalize the spectrum of occurred microorganisms, namely pathogenic species and strains. The fulfilment of this condition assumes the inclusion of managed composting process to the technology of separation and utilization of beef slurry separate as litter in box stabling of dairy cows.

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Bedding material and its maintenance are important factors impacting the quality of environment of stabled animals. Proper choice and care of bedding affects the length of periods of cows’ lying, the cleanliness of their body surface, the quantity of injuries and also the incidence of diseases. From the viewpoint of welfare the system of cattle stabling is considered ethologically fully adequate, unless the state of health and natural behaviour of animals is disrupted or a long period of assimilation to stabling conditions is enforced (NOVÁK et al., 2000, 2001). In the frame of welfare determination there are often used the ethological studies by using tests of preferences. They are based on supposition of animals’ individual choice of the most convenient alternative out of offered possibilities or their effort to find better or avoid worse conditions. Nevertheless, the common practice shows that beside creation of routine stereotypes and more strongly preserved instincts the dairy cows use very markedly the hierarchical system of superiority and inferiority and their individuality climbs up to the forefront (SAMEK a JÍLEK, 1994, 1997).

The suitability of special types of stabling is often assessed on the base of periods of animal lying and ruminating. These basic ethological parameters can be influenced by various details of stabling systems or by different management (O’CONNELL et al., 1989). Under the common conditions cows during the period of 24 hours spend 9 – 12 hours by lying (SÜS a ANDREAE, 1984). The period of lying in inconvenient boxes and on conditions of overfilled stable is shorter than on optimized conditions (WIERENGA and HOPSTER, 1990). Very important is the finding that dairy cows need a rest after coming back from milking, i.e. most of them lie down for a certain time, which corresponds with the finding of KONOPÁSEK (1994). The behaviour of animals with the lowest social status can be indicated as unsure and fixed to the superiors. For instance the inferior cows lie for a shorter time. The yield capacity is below average of the group. A considerable part of animals in the group is indifferent. For their daily regime a great share of rest period is characteristic. Their achieved yield capacity is slightly above average.

The aim of the study was to determine the selected chemical and physical properties of separated slurry, to evaluate the diary cows’ state of health, the quantity and quality of milk production, to detect the occurrence of parasites in separated slurry and to compare the period of lying in diary cows stabled on the premises with plastic litter from separated slurry and on the premises with classic straw litter.

Materials and Methods

The experiments were performed in two herds of dairy cows of Holstyn breeding stabled in the brick buildings with loose boxes stabling system and with grid dung-passage system. Water supply was provided by the system of feeding trough, the mixture of the feeding ration was given by a mixing car to a feeding hall. The ventilation was mainly natural, during hot summer days also electric ventilators were used. Separated slurry was used as litter in one of the buildings,
classical stabling regime with straw litter in the other one. The volume capacity of one bed in experimental building was 0.5 m³ and it was necessary to replenish approximately 0.15 m³ of this plastic litter each month. In the comparative stable the straw in the amount cca 4 kg was added to bed each day.

The samples of slurry were taken according to usual methodology. The determination of occurrence of selected groups of microorganisms and moulds in separated slurry was provided in the State Veterinary Institute in České Budějovice according to given methodology, evaluation of parasitic occurrence was assessed in a special laboratory of the Faculty of Agriculture, University of South Bohemia and at the research establishments of Academy of Science in České Budějovice. Blood and excrements analyses were made at laboratories of the Faculty of Agriculture according to valid methodologies by usage of BIOLA tests and atomic absorption spectrophotometry. The evaluation of microclimatic conditions was monitored in 1-hour intervals by usage of the Comet system, the marking of the cleanliness of the body surface passed visually according to methodology of VELEBIL and DOMANSKÝ (1968) modified by ŠOCH (1989).

For the detection of suitability of the litter from separated slurry ethological observations were realized at the beginning of April, in the middle of May and at the end of October, always in 10-minute intervals during the whole 24 hours. There were observed selected vital manifestations in stabled animals – mainly periods of standing, lying and other activities in both stables (on straw litter – monitored approximately 53 cows; on separated slurry – monitored approximately 66 cows). Consequently „CCI – cow comfort index“ was calculated from the results, which indicates how many cows from the total amount of the cows (in percents) are lying during the evaluation.

The data about the quantity and quality of milk production and the state of health of comparative herds were obtained from the zoo veterinary register.

**Results and Discussion**

There was monitored the impact of biothermic purification through the method of managed composting and various periods of thermal and stable exposition on the occurrence of microbial and parasitic agents in separated slurry. Beside that, component samples of separated slurry were exposed to one week thermal effect in thermostat by 50, 55, 60, 65 and 70 °C. From the microbiologic viewpoint significant tendencies to the decrease of density of microbiological species and their total number are obvious. Similarly, we can assess the question of devitalisation of monitored parasites. Also here considerable tendencies to their decrease up to vanishing were observed in so modified separated slurry. Low occurrence of parasites in separated slurry indicates high devitalisation efficiency of warming process in slurry during its composting and its safety for animals as plastic litter in aspect of parasitic infection. At the same time, in the excrements taken directly from the rectum of cows 80 % occurrence of Giardie, mostly in the amount of one cross was founded.

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Occurrence of parasites in separated slurry

<table>
<thead>
<tr>
<th>Monitored parasites</th>
<th>Freshly separated slurry</th>
<th>Compost 1 week</th>
<th>Compost 7 weeks</th>
<th>New litter in box</th>
<th>Litter - box 3 weeks</th>
<th>Litter - box 5 weeks</th>
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<tbody>
<tr>
<td>Giardia</td>
<td>Very isolated</td>
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<td>+</td>
<td>Isolated</td>
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<td>Strongyloides</td>
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<tr>
<td>Strongylus</td>
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<td>Isolated</td>
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<tr>
<td>Cryptosporidium</td>
<td>Very isolated</td>
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Current state of health of monitored herd was assessed through the method of shortened metabolic tests. Ascertained values of blood and urine analyses indicate that state of health of the herd is from the monitored parameters in good order. The state of health of cows during the one year usage of separated beef slurry as plastic litter corresponded by the frequency of occurrence of various sorts of diseases with common state of health of herd before the establishment of this method of bedding. The inflammation of mammary gland was the most often disease, consequently the diseases of limbs, then the reproduction problems. The lowest number assigned the diseases of digestive and respiratory tract. The herd exhibited the increase in milk production in the years 2005 and 2006.

There were found no big amplitudes even in the quality of milk; milk was always classified as the first class quality. The quality of produced milk corresponded in all monitored parameters with the demands for standards during the whole time of observations.

The microclimate of the stable littered by slurry separate was similar to the microclimate of the stable with classical straw litter, while relative air humidity was the factor whose parameters mostly oscillated and exceeded recommended values.

Ethological observations proved the suitability of litter from separated slurry.
Hypothesis based on knowledge of natural antagonism of cattle to excrements was not confirmed. Although cows on the pasture avoid excrements, because their stench is revolting for them, in the boxes littered by slurry separate they lie down as well as in the other kinds of beddings.

The values of „CCI – cow comfort index“ were calculated from ascertained figures. In April this value was 0.49 at the stable littered by separate and 0.48 at the stable littered by straw. Average time of lying of one piece was 701 minutes for cows on the separate litter and 690 minutes on the straw litter during 24 hours observation. In May the results of ethological observation were influenced by the change over of agricultural cooperative to three-phase milking. Calculated value of cow comfort index was 0.45 on average at the stable littered by separate and 0.49 at the stable littered by straw. Average time of lying of one piece was 648 minutes for cows on the separate litter and 705.6 minutes on the straw litter. In October its value was 0.43 on average at the stable littered by separate and 0.46 at the stable littered by straw. Average time of lying of one piece was 619.2 minutes for cows on the separate litter and 662.4 minutes on the straw litter.

From the results follows that percentage and time of cows´ lying were approximately the same in both technologies. Ascertained periods of cows´ lying moved in both technologies near the upper limit that quote for standard conditions SÜS and ANDREAE (1984). With respect to finding of WIERENGA and HOPSTERA (1990) that lying in unsuitable boxes and under conditions of overfilled stable is shorter than lying in boxes under optimized conditions and that the system of loose boxes for dairy cows increases essentially peace in the stable (ŠOCH et al., 2000), our experiment confirms that both systems of bedding were for dairy cows fully convenient. Moreover the observations also showed that cows whose bedding was littered by separated slurry returned more often to the same boxes than the cows stabled on straw litter. It could indicate that each single dairy cow adjusts the shape of the bed to its body and that is why the cow comes back according to the possibilities with respect to hierarchy in the herd to have a rest in its own bed that was formed by their own body. The other facts that were confirmed are a great importance of feeding troughs located in the waiting rooms of milking parlor and the dairy cows´ need of relaxing after return from milking, i.e. that most of them lie down for some time. It is very important that dairy cows must not be disturbed after their return from milking.

It corresponds with the findings of KONOPÁSEK (1994) that is based on the supposition of animals´ individual choice of the most convenient alternative from offered possibilities or their effort to find better or avoid worse conditions (SAMEK and JILEK, 1994, 1997) and also with findings of NOVÁK et al. (2000, 2001) that from viewpoint of welfare the system of cattle stabling is considered ethologically as fully adequate, unless the state of health and natural behaviour of animals is disrupted or a long period of assimilation to stabling conditions is enforced.

From the viewpoint of the cleanness of the body surface of the diary cows stabled on the litter from separated slurry classified according to Domanský
method (VELEBIL and DOMANSKÝ, 1968), modified by Šoch (ŠOCH, 2005) only contamination of small-size surface was ascertained. From the comparison of achieved results of the monitored stable and the results of measuring presented in the report of Velebil and Domanský (1968) follows, that the system of loose boxes stabling can be evaluated from the viewpoint of cleanness of the body surface of stabled animals as very good. Because of neck barrier, the cows did not excrete in the space of their own bed. That is why the contamination was observed mostly on the tail of animals that could reach into the areas of the dung corridor, where the animals excreted. Partial occurrence of excrement contamination was found also on hocks, on thigh parts of pelvis limbs, on wrist and metacarpus and very rarely on the front abdominal region, on udder and teats. It is possible to suppose that hocks and thigh parts of pelvis limbs were contaminated only secondarily, probably by transfer from the contaminated tails, the contamination of wrist and metacarpus was caused by standing up and lying down. This contamination could be eliminated by increasing of the share of the dry matter in separate that varied during the experiment. The oscillations in the content of the dry matter were partly caused by the changes of the year seasons (the decrease especially in winter).

The number of contaminated places was higher in cows stabled on straw (6 % on average). Whereas the contamination of the first areas (i.e. the areas related with the cleanness of milk) appeared in the cows littered by separate only rarely, in the cows littered by straw was approximately twice higher, which means a risk, especially from the viewpoint of cleanness of milk. Also the composition of feeding ration had a considerable influence on the pollution of both monitored groups.

Conclusions

The hypothesis based on the knowledge of natural antagonism of cattle to excrements was not confirmed. There were ascertained significant tendencies to the reduction of number of microorganisms and parasites in separated slurry converted by the biothermic process through the method of managed composting. In the samples of separated slurry taken from the litter microorganisms and parasites occurred in quite a small number and only after three weeks from bedding they began to proliferate slowly. From the viewpoint of the cows’ state of health, the quantity and quality of their milk production, the cleanness of their body surface, the average time of lying and other evaluated welfare parameters under given microclimatic conditions the usage of separated beef slurry as plastic litter fully complied.

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