



Use of machines for liquid manure aerating and mixing

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Abstract: The paper is concerned about the ecological aspects of liquid manure. In order to have a better insight into the efficiency of the machine, four sample of liquid manure were analysed, namely two samples from a pit without aerators and two samples from a pit with incorporated aerator. The analysis showed that the dry matter content in the liquid manure amounted to 5,05 - 5,74 %. The sample, taken from the pit with incorporated aerator after 20 minutes of mixing, contained the greatest quality of the dry matter. The nitrogen and phosphorus content is equal to the average; again the sample taken out of the pit with aerator stands out. The values of potassium exceeded the European average. The aerated liquid manure is spread on the surface more uniformly, it flows faster off the plants and penetrates faster into the ground up to the roots. When the aerated liquid manure is sprinkled, the bad smell in the environment is considerably lower. Pumping into the cistern is much easier because it does not contain clods. The fodder remains are chopped and do not stop up the pipe. The cost of aeration is small in comparison with the devices for liquid manure mixing.

Keywords: Ecological aspects, Liquid manure, Machine, Aerating, Mixing.

1. INTRODUCTION

In case of aerated liquid manure breaking of the hard cover floating on the top of the liquid manure and preparation of liquid manure by mixer are omitted. The contribution presents a device for liquid manure aeration, consisting of an electric motor submersible pump with built-on injector for blowing air into the liquid manure and with incorporated chopping plate. The knife and the chopping plate chop the fodder remains and other matters coming into the liquid manure. The aerated liquid manure can be used at any time, because it is always ready for transport. As the treated liquid manure is mature, it does not burn the plants and can be sprinkled as and when necessary. If during aeration the temperature of the liquid manure rises to 25 – 30 °C, germination of the weed plant seeds is reduced and a considerable number of parasites and disease causers are destroyed.

2. AERATION

The aeration is a technical version of the biological oxidation of some organic substances in liquid manure and represents a modern process of the liquid manure treatment. The aerated liquid manure does not stink, it is partly sterilised and contains less ammoniac, therefore it can be used also during vegetation. Thus, the time of manuring is extended and the requirement for the storage space is reduced. The main disadvantage of aeration is that it is expensive due to high investment, operating and maintenance costs. Biological processes, during which the oxidation of ammoniac and sulphuretted hydrogen taken place, ensure the removal of the bad smell imparted by these compounds to the liquid manure in pits or pools [1].

3. DESCRIPTION OF LIQUID MANURE MIXER AND AERATOR

The aerator with the flushing system is a device for blowing of air and homogenization of the liquid manure. By means of a hoisting winch the pumps, equipped with an injector, is placed in the storage pod. A 4 kW electric motor drives the two-side turbine mixing the liquid manure in the pit (tank) and re-pumping it simultaneously into the flushing channel or box. During the liquid manure flow through the injected the low pressure is created to ensure the air supply into the liquid manure. The oxygen from the air oxidates the ammoniac and ensures the action of the aerobic bacteria decomposing the organic matters. Rotting of organic matters in liquid manure is thus significantly reduced. The knives, placed in the pump mouth, cut the manure clods and fibrous fodder remains. Thus the liquid manure becomes an easily flowing mixture of water and solid matters. Due to flowing out of the spray pipe strong stream, mixing the liquid manure and preventing deposits from forming, is created [2].

The device is used also for cleaning stable channels with treated liquid manure are for re-pumping liquid manure into the cisterns. During operation the device injects the air, so that the liquid manure matures faster due to the presence of oxygen and stinks less when it is transported and sprinkled on the surfaces. It is an advantage of this machine that the liquid manure is ready for transport at any moment, whereas sludge does not accumulate in channels but flows into the storage pit. Figure 1 shows the programmed mixer for liquid manure.

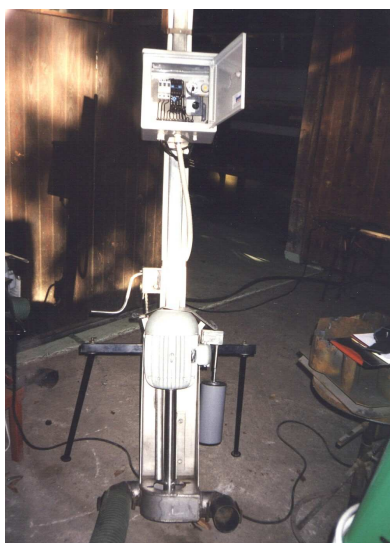


Figure1. Programmed mixer for liquid manure

4. CHEMICAL ANALYSIS OF LIQUID MANURE

Chemical analysis of liquid manure was made at the Institute of Agriculture in Maribor. The samples were analysed for the dry matter content, pH value, nitrogen (total, ammoniacal, nitrate), potassium, phosphorus and organic matters (Table 1).

Table 1.
Results of analysis of liquid manure

	Dry matter (%)	pH	Organic matter (%)	P ₂ O ₅ (%)	K ₂ O (%)	N total %
Liquid manure - Farm A	5,57	6,74	4,50	0,10	0,54	0,16
Liquid manure - Farm A (Channel)	5,11	6,83	3,93	0,26	0,45	0,14
Liquid manure - Farm B (Before mixing)	5,05	7,34	3,59	0,12	0,63	0,23
Liquid manure - Farm B (After mixing)	5,74	7,37	4,15	0,28	0,70	0,26

5. RESULTS WITH DISCUSSION

Table 2 shows the statistical presentation of analysed values.

Table 2.
Statistical presentation of analysed values

	x _i (%)	μ	σ ²	σ	KV
Dry matter	5,57	5,3675	0,0868	0,2945	0,0549
	5,11				
	5,05				
	5,74				
pH	6,74	7,07	0,0822	0,2867	0,0406
	6,83				
	7,34				
	7,37				
Organic matter	4,50	4,043	0,1096	0,3310	0,0819
	3,93				
	3,59				
	4,15				
Total nitrogen	1,6	1,975	0,2419	0,4918	0,2490
	1,4				
	2,3				
	2,6				
Phosphorus	1,0	1,9	0,65	0,8062	0,4243
	2,6				
	1,2				
	2,8				
Potassium	5,4	5,8	0,885	0,9407	0,1622
	4,5				
	6,3				
	7,0				

x_i - dry matter content (%); μ - arithmetic mean; σ² - variance;
σ - standard deviation; KV - coefficient of variation

The dry matter contents, analysed in the laboratory, amounts on the average to 5,37 %. In the liquid manure without aerator the average was 5,34 % and in the liquid manure with aerator it was 5,40 % [3]. The pH content was 7,07 on the average. The average value pH was lower in case of liquid manure without machine, namely 6,79. In case of liquid manure with the machine the average was 7,35. The average organic matter amounted to 4,04 %. The value of the organic matter in non-aerated liquid manure is higher than in the aerated liquid manure. The average of the total nitrogen amounts to 1,98 kg/m³ and is lower than the European average, particularly due to low % of the dry matter. The sampled liquid manure was rather thus the average values of nitrogen were higher in the sample of aerator liquid manure than in the sample of non-aerated liquid manure. The average value of phosphorus was 1,9 kg/m³ in which is equal to the European average. With respect to phosphorus the values of samples with and without aerator did not differ much. The average value of potassium amounted to 5,8 kg/m³ which considerably exceeds the European average. This is probably due to the animals feed. In the sample without aerator the average amounted to 4,95 kg/m³ and in the sample with aerator to 6,65 kg/m³. In all cases, except for phosphorus, the value in the sample of liquid manure with aerator considerably exceeded the value in the samples without aerator. The results are very interesting and are in favour of the machine described [4].

6. CONCLUSION

Aeration is a process of introducing and blowing the air. The purpose of introducing the air and oxygen, mixing and chopping of admixtures is that: the liquid manure is layered and smoothly flowing, mixing immediately prior to transport is omitted, the liquid manure considerably less stinks, germination of weed seeds, numbers of disease causers and parasite in liquid manure are decreased and development of fly larvae is avoided. In case of aerated liquid manure the deposits are not formed. Aerated liquid manure is smoothly flowing, it does not stick to the plants, it flows fastly off them and penetrate faster into the ground. The possibility of contamination of meadow plants is reduced. After the case of liquid manure, treated with aerator, cattle may graze much sooner than in case of non-aerated liquid manure, since the grass does not stink. In case of aerated liquid manure breaking and tearing of the hard cover, otherwise floating on the liquid part, is omitted. The cover tearing must be effected before transport of the non-aerated liquid manure by means of the liquid manure mixer. Due to it's homogeneity the aerated liquid manure is always suitable for transport. When used, there is no risk of burning of the meadow plants.

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