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INTERREG SLURRY ACIDIFICATION TECHNOLOGY PROJECT DEVELOPED BY BALTIC REGION COUNTRIES

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Summary

Acidification of animal slurry has proved to be an efficient solution to minimize NH_3 emissions in-house, during storage, and after soil application, as well as to increase the fertilizer value of slurry, without negative impacts on other gaseous emissions. This solution has been used commonly in Denmark, and its efficiency withregard to the minimization of NH_3 emissions has been documented in some studies. Acidification reduced NH_3 emission from stored slurry to lessthan 10% of the emission from untreated slurry, and the NH_3 emission from applied slurry on the field was reduced by 67%.

Introduction

Technical report concerning feasibility studies for pilot installations of InterregSAT's activity was provided. In application form "in storage" system was planned to utilized in Polish conditions. In the project there

are involved all Baltic countries: Sweden, Denmark, Finland, Germany, Poland, Estonia, Lithuania and Latvia. Also Russia and Belarus are involved as a cooperating members of the project.

ITP has three experimental farms located in a distance of about 300 km one from the other. In each of that there farms there are barns with approximately about 180 cows in each site. Experimental farm in Falenty has chemical laboratory, which can provide sample tests taken from acidification experiments. This situation made a decision to plan two concrete tanks of approximately 12,5 m^3 each to provide two different experiments; slurry acidification research and concrete tests concerning influence of harmful substances on the construction material itself.

Figure 1 shows two concrete tanks staying side by side, one is for fresh slurry and the other for acidified one. These two concrete tanks are equipped in one mixer and one pump, which can be moved very easy from one tank to the other , depending on the requirements. Fresh slurry from right tank is pumped to the left tank, where acidification occurs. Acidification process is controlled by pH meter. When process is completed acidified slurry is taken by a tanker using discharge pipe RB.

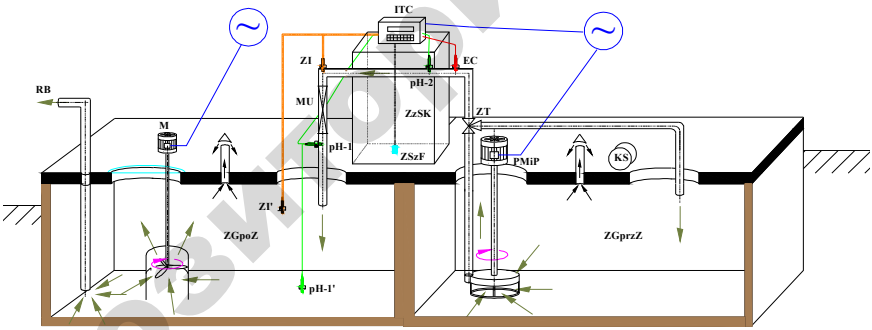

Figure 1. – Experimental pumping of fresh slurry to acidification tank

Analysis of different storage tanks and acidification systems was provided. Also economic analysis concerning possible usage of acidified slurry on different crops as: corn, wheat, grass etc. was provided. Also costs of energy as electricity, gas, petrol etc. were taken into consideration. Technical documentation of two concrete tanks were elaborated. On the basis of procurement which fulfill EU and Polish law building contractor for concrete tanks construction was chosen. To pro-

vide acidification process in these two tanks special automated system was elaborated. The main elements of that system are; pump, mixer, pH meter, temperature meter. When slurry achieve proper pH value then it is pumped to the tanker with trailing hoses, which will spread acidified slurry on field plots to provide farther experiments. After analysis of different "in storage" systems present on Danish market, there were chosen one of the system, which can be suitable to the Polish animal herd sizes and possibility of safe acid delivery on the farm, where acidification process will be provided. These system contain the following main elements: main frame with power transmission taken from PTO of the tractor, slurry mixer, acid pump, which deliver acid from truck with acid to the area of slurry mixer activity, pH meter, which can check when proper PH level of slurry is achieved. According to the Polish and EU law procurement process of buying "in storage system" in Denmark is provided. Together with Radom Advisory Center ITP is looking for suitable farms, which can be useful to provide field open days for farmers and decision making organization, to promote slurry acidification system.

To study an effect of the influence of acidic slurry on concrete produced standard concrete samples measuring 15x15x15 cm made from two grades of concrete C25/30 and 30/37 in an amount of 66 pieces. As a medium was taken aggressive slurry acidified to a pH of 5.5. All samples after construction by the company Hydrobudowa undergone a process of care and maturation for a period of 28 days under conditions specified in the standard. Then samples were placed in an acidified slurry, normal slurry and water. Time storage of samples in different media was set at; 6 months, 12 month and 18 month. The samples will undergo strength tests of concrete and selectively microscopic examination of SEM. The endurance test shall be a subject of three samples, of which the average value is calculated.The reference point is obtained compressive strength of concrete samples after 28 days of ripening and comparison with the results of strength tests and microscopic one conducted on samples stored in various media in different periods of time.For laboratory tests on the effects of acidic slurry on reinforcing steel, prepared in the laboratory Hydrobudowa, samples of concrete with embedded reinforcement. In samples with dimensions 4x4x16 cm of amount 33 pieces is placed a rod of diameter 6 mm protected by a concrete layer with a thickness of 2mm, 7mm and 17mm.Samples were placed in the media; acidified slurry, normal slurry and water. The samples will be kept for a period of; 6 months, 12 month and 18 month. To measure of the impact

of the corrosive action of acidic slurry will be the toughness of the samples on strength when bending. The survey will be carried out on a strength testing machine. Samples will be also a subject to macroscopic evaluation.The reference point is reached breaking strength of concrete samples after 28 days of ripening and macroscopic evaluation of steel reinforcement. The results will be compared with results from research samples stored in different media for different periods of time.

Acidification of slurry is spontaneously changed, why was introduced monitoring of the level of acidity of pH and temperature.

Mobile acidification equipment could be suitable for acidifying the slurry in storage during mixing just before spreading. Such equipment could be invested in by the farmer. Mobile equipment implies that the cost can be shared if the same equipment is used on several farms. The service could also be hired from a contractor, under the conditions that there is a contractor in the neighborhood providing this service.

Figures 2 show the equipment, which will be delivered by ORUM Co. from Denmark.

These professional equipment can have big influence on farmers interest with large herd size of animals in Poland.

Figure 2. – OrumSemden's "in storage" acidification system at work (farm in Denmark)
Source: ORUM Co promotion material 2017

Just to explain why ammonia evaporation doesn't exists, it can be explained by drawing the following equilibrium in slurry between ammonium salt and ammonia gas

$$NH_4^+ + OH \leftrightarrow NH_3 + H_2O$$

At pH=6,4 all mineralized N is found as ammonium, and no evaporation takes place.

In Denmark, the slurry should after lowering the pH <6 be spread within 24 hours according to rules. As the spreading season last for longer times, this could mean a period of several weeks per year. Eco-

nomical calculations are needed to compare which solution is most profitable for individual farms. When hiring the service of acidification, the technology will be available also for smaller farms. Also, if surplus storage volume is needed because of foaming when adding acid, may make the alternative non-profitable compared to the other two alternatives.

Conclusions

Acidification reduces NH_3 emission from pig houses by 70% compared with the standard housing treatment. Little loss was observed from stored slurry, and the NH_3 emission from applied slurry was reduced by 67%. In consequence, a 43% (S.E. 27%) increase in mineral fertilizer equivalent (MFE) was measured in field studies. The slurry acidification system is approved Best Available Technology (BAT) in Denmark.

pH level of 5,5- 6,4 is not very acidic, and no more acidic than rain water, which has a normal pH range from 4,5 to 8,5.

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