FAO European Cooperative
Research Network

RAMIRAN

Recycling of Agricultural, Municipal and Industrial Residues in Agriculture

Network Coordinator: José Martinez, Cemagref, Rennes (France)

RAMIRAN 2002

Proceedings of the 10th International Conference of the RAMIRAN Network

General Theme: Hygiene Safety

Štrbské Pleso, High Tatras, Slovak Republic
May 14 - 18, 2002

Edited by Ján Venglovský and Gertruda Gréserová

ISBN 80-88985-68-4

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EMISSIONS OF ODOUR AT THE CO-INCINERATION OF MEAT-BONE MEAL

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ABSTRACT

After plenty of BSE (bovine spongiform encephalopathy) cases in Europe and 2 BSE cases in Slovenia, we also included in precaution measures for prevention of contagious diseases spreading the prohibition of feeding livestock with animal source fodder (meat, bone, blood, feathers meal, etc). In that way, we confronted with enormous quantity of animal source fodder that became a waste material. In Slovenia approximately 180 tons of animal waste are collected from carcass collecting points and slaughterhouses per a day. After remaking them at rendering plants, there are approx. 40 tons of organic waste produced. Slovenia does not have special incineration plants, so we made a research on how to make an incineration of organic wastes from rendering plants in power plants, where they are used as organic fuels. Results show that odour emissions are lower when meat-bone meal is added to lignite. The degree of reduction of odour emission is different and depends upon working power of energetic unit. The emissions of unpleasant odours can be decreased by 20,0 to 66,77 %. We found that incineration of meat-bone meal (MBM) is a solution from the environmental protection point of view. The MBM also has a marked energy value that depends upon its composition. To reach the same energy is needed less lignite and at the same is lower the burdening of the environment with unpleasant odours is lower.

INTRODUCTION

Preventive measures against contagious disease transmission by animal wastes go back to 1981, when the government of that time introduced compulsory heat treatment (sterilisation) of animal wastes. The veterinary administration regulated the importation of animals and meat and bone meal (MBM) by import constrictions. After 1993, the import of the MBM was possible only when its production met special prescribed conditions, that is, if the product was thermally treated at a minimum temperature of 140°C for at least 30 minutes at a pressure of minimally 3 bars. In 1996, Slovenia prohibited the feeding of the MBM to ruminants. [1,2] In December 2000, at the same time as in the EU, the prohibition of feeding the MBM was extended to all animal species used for human consumption. [3,4]

Due to the abovementioned measures, the problem of treating the MBM as animal waste emerged in Slovenia. A strong resistance of the causative agent (prion) to temperatures of up to 600 °C markedly decreases the possibilities to suitably dispose the MBM.[5] For the time being there is no biological process which could sufficiently remove the BSE causing agents from materials.[6] Due to the high energy value, 18 to 22 MJ/kg (depending on fat contents), and due to the high content of dry solids, above 90%, the MBM is a good raw material for incineration.[7] Low content of heavy metals and sulphur, in comparison to other types of wastes and to coal, places the MBM amongst cleaner fuels.[8]

Additional attention must be given to dust emissions.[8] Incineration and co-incineration are the two methods suitable for treatment of wastes with high or specific risk level, and the two are approved by Slovenian legislation which complies with EU directives.[3,4] The MBM is suitable for combustion in coal-fired power stations, as the particle size of the MBM complies with the requirements.[7]

When experimental co-incineration took place in the Šoštanj coal-fired power plant, our Institute performed a study and measurements of the level of the burden to the environment due to unpleasant odours while incinerating the MBM. By experimental incineration, we were looking for the level of burdening the environment with odour. We took samples of air, depending on the length and diameter, from air canals at the reference place at the height of 60 m. In order to find differences in emissions of odour, we done researches at different levels of energy production before adding meat-bone meal. We compared the data with the results obtained when incinerating lignite and adding bone-meat meal. In the experiment, we changed the quantity of bone-meat meal for different quantities of energy production at that unit.

MATERIAL AND METHODS

In our study we tried to find out the difference in environment burdenenig with unpleasant odours between normal incineration and the co-incineration of the MBM in different quantities. The coal-fired power plant Šoštanj is the biggest steam plant in Slovenia with the electrical energy capacity of max. 755 MW. It is fuelled by lignite from a nearby coalmine. This power plant consists of five energy units. One of them was used in our experimental co-incineration of the MBM. The MBM was pneumatically transported into a block of the plant in quantities of 5 to 10 tonnes per hour.

Air samples for olfactometry were taken from the chimney at the height of around 60 m from a sampling opening. They were taken by a teflon probe connected to the sampling vessel by means of under pressure (sucking out the air from the vessel) into special sample bags. 17 samples were taken from the sampling site. Odour concentrations of air samples were assessed by dynamic olfactometry with Olfaktomat PRA3M (Project Research Amsterdam). The results of measurements were calculated by Dravniek Software (PRA). The air flow was measured with a pilot tube.

RESULTS

On the first day, zero measurements were performed. The working power of the power plant unit was 200 to 300 MW at the time. Emissions of unpleasant odours at the working power of 200 MW amounted to 1,305,163.22 Ou/s, while at the working power of 300 MW they amounted to 1,592,188.74 Ou/s.

The next day the working power of the unit used in the experiment was 345 MW. In 6 hours, 50 t of the MBM were blown into the furnace. The emissions of unpleasant odours amounted to 1,375,570.61 Ou/s. Considering the working power, which was 45 MW higher than at zero measurements, we can asses that the emissions of unpleasant odours were lower by approximately 20 % compared to lignite combustion.

The third day, the power of the plant unit was 200 and 280 MW. During each regime, we co-incinerated 25 tones of the MBM. When the unit was working at 200 MW, the emissions of unpleasant odours amounted to 433,711.80 Ou/s. Compared to zero measurements; we can establish a 66.77 % reduction. When working at 280 MW, the emissions amounted to 612,484.07 Ou/s in 5 hours. The results were compared to those

measured at the working power of 300 MW on first day. Considering the difference in the working power of the unit, we can assess that there was a 58.03 % reduction of unpleasant odours.

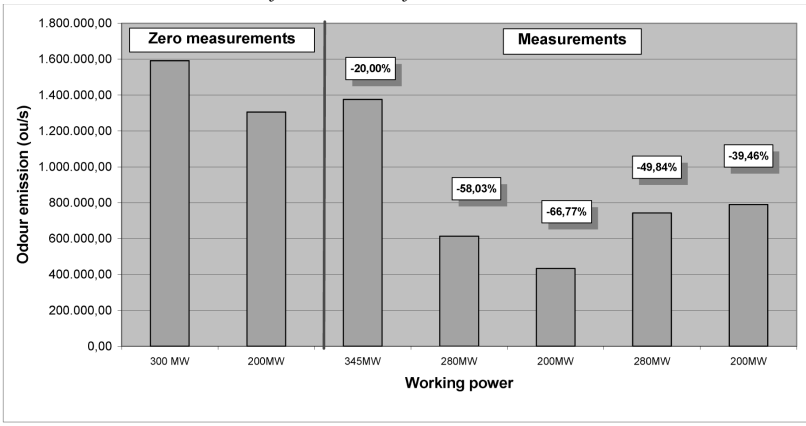
On the fourth day, the measurements were the same as on the third day. Unpleasant odours measurements at 200 MW working power amounted to 790,184.89 Ou/s. A 39.46 % emission reduction was established compared to zero measurements. When the plant worked at 280 MW, unpleasant odour emissions amounted to 742,867.94 Ou/s and in comparison to zero measurements, emissions were lower by 49.84 %.

The results of measurements are shown in Table 1 and Diagram 1.

Table 1: The results of olfactometric measurements at different working powers of the unit in experimental incineration of the MBM

Date	Num.	Working power (MW)	Odour conc. (Ou/m^3)	Average odour conc. (Ou/m^3)	Air flow (m^3/s)	Odour emission (Ou/s)	Average odour emission (Ou/s)
1st day	1	300	2.231,50	3.016,63	527,78	1.177.741,07	1.592.118,74
	2		2.723,90		527,78	1.437.619,94	
	3	200	1.288,10	3.132,37	416,67	536.712,63	1.305.163,22
	4		7.006,70		416,67	2.919.481,69	
2nd day	5	345	1.209,30	2.606,33	527,78	638.244,35	1.375.570,61
	6		4.964,00		527,78	2.619.899,92	
	7		1.645,70		527,78	868.567,55	
3rd day	8	280	2.413,70	1.469,95	416,67	1.005.716,38	612.484,07
	9		526,20		416,67	219.251,75	
	10	200	1.076,00	1.040,90	416,67	448.336,92	433.711,80
	11		1.005,80		416,67	419.086,69	
4th day	12	280	1.991,70	1.407,53	527,78	1.051.179,43	742.867,94
	13		1.007,30		527,78	531.632,79	
	14		1.223,60		527,78	645.791,61	
	15	200	1.659,90	1.777,93	444,44	737.725,96	790.184,69
	16		1.217,10		444,44	540.927,92	
	17		2.456,80		444,44	1.091.900,19	

Diagram 1: Working regimes and unpleasant odour emission values at zero measurements (no MBM) and experimental measurements (MBM added). The diagram also shows the deviations of test values from zero values.



DISCUSSION AND CONCLUSION

The sampling of air was performed during electrical power production. Because the working power of the plant is always adjusted to the current electrical needs in Slovenia, using the same working power throughout the whole experiment was not possible. This is the reason why the results are presented as an assessment of the difference between zero and experimental measurements.

When experimentally co-incinerating the MBM, the differences in unpleasant odour emission values are noticeable between the third and the fourth day, although the quantity of combusted MBM and working power were the same on both days. The measurements show a decrease in unpleasant odour emissions by 49.84 % or 58.03 % when plant is operating at 280 MW working power. When operating at 200 MW power, the reduction of unpleasant odours amounted to 39.49 % and 66.77 %, respectively. The combustion rate of the MBM in both cases was 5 tonnes per hour. Greater differences, noticed when incineration was performed at 200 MW, can be caused by uneven dosage of the MBM. Also, the quality of the MBM could influence in a way the unpleasant odour emissions. The same problems have been presented by several authors who point out that the technology of incineration can influence emissions. The findings show that the minimum temperature should be 850 °C in 2 seconds and minimally 6 vol % of O_2 should be provided.[8] During the pneumatic feeding of the furnace, occasionally the MBM tended to become lumpy, which caused uneven burning and, consequently, unpleasant odour emissions.[8]

During the experimental co-incineration of the MBM we used two different rates, namely 5 tones per hour or 10 tonnes per hour. From the environmental pollution point of view, we recommend the co-incineration of 5 tones per hour at the working power of 200 MW. At this intensity, the established burdening of the environment with unpleasant odour emission was the lowest.

REFERENCES:

1. Navodilo o ukrepih za ugotavljanje, preprečevanje in izkoreninjenje goveje spongioformne ecefalopatije.; Ur.l.RS, Št. 71/96
2. Odredba o prepovedi uporabe mesno kostne moke v prehrani prežvekovalcev. Ur.l.RS, Št. 27/96 in 68.
3. European Communites: Regulation laying down ruls for the prevention, control and eradication of certan transmisibile spongioformn encephaloties. (EC) No. 999/2001 OJ L 147.
4. Odredba o dodatnih preventivnih ukrepih v zvezi z transmisivnimi spongioformnimi ecefalopatijami Ur.l.RS, Št. 115/00.
5. Sioen H.: From mad cow crisis to clean energy; http://www.scienetecmatrix.com
6. Brown, Rau, Johnson, Bacote, Gibbs, Gdjdusek. New study on the heat resistance of hamster-adapted scrapie agent. Proc Nat Acad Sci USA 1999 in 97, 3418-3421. http://www.ifst.org.hottop5.htm
7. Council of Environmental Experts: Umweltgutachten 1998; Verlag Metzler-Poeschel Stuttgart 1998; 106
8. Nottrodt A, Wandschneider J, Gutjahr M, Chibiorz J. Tecnical Requirements and General Recommendations fort he Disposal of Meat and Bone Meal and Tallow. Umweltbundesamt, Berlin 2001