The effect of electromagnetic water treatment on *in vitro* methane production

M O'Brien, P O'Kiely
Teagasc, Grange Beef Research Centre, Dunsany, Co. Meath, Ireland *Email: martin.obrien@teagasc.ie*

Introduction It has been reported that when water is treated with magnetic or electromagnetic fields it can enhance the growth rate of plants and animals (Colic and Morse 1998). The mechanism by which it acts is subject to on-going research, but one theory is that it is the gas-water interface (either intrinsically present gas or gas produced in response to electromagnetic and magnetic fields (EMF)) or water around non-polar species, which are the primary targets of EMF action. Production of free radicals and other reactive oxygen species such as ozone and hydrogen peroxide (H_2O_2) seem to be responsible for some of the observed effects after EMF water treatment (Colic and Moose 1999). The properties of EMF treated water could be used as a potential methane mitigating strategy in livestock production. One hypothesis is that the treated water may inhibit methanogens through the production of H_2O_2; methanogens lack catalases to breakdown H_2O_2. Additionally, owing to the purported higher oxygen content in EMF treated water, it could firstly make the rumen less desirable to methanogens and secondly, the additional oxygen should provide an additional sink for hydrogen thereby reducing methane formation. This study examined the potential of EMF treated water to suppress methane production in contrasting livestock feeds using the *in vitro* rumen total gas production (TGP) assay.

Material and methods The methane output for four contrasting livestock feeds (i.e. ryegrass, grass silage (S), barley grain (B) and S + B (50:50 on a dry matter basis)) was assessed using EMF treated and non-EMF treated water (control). The water in each case was the soluble component used to prepare the McDougall buffered medium. The buffer was EMF treated using the Energy Interface Delivery System (ZPM Europe Ltd, Ireland). In preparation for the *in vitro* TGP fermentations, each feed was dried (40°C; 48 h) and milled (1mm sieve) and a sample of each was weighed (0.5 g) into an incubation vessel (160 ml) and inoculated with 10 ml rumen liquor and 40 ml of McDougall buffered medium. There were three replicates of each feed per treatment and each replicate was inoculated with a different rumen liquor (RL) source. The RL was collected prior to morning feeding from three fistulated steers (60:40 silage to concentrate diet). Vessels were flushed with CO_2, sealed and incubated at 39°C. Dispensing the EMF treated and non-EMF treated buffer was undertaken simultaneously but in two different laboratories 100 meters apart to prevent cross contamination. Gas pressure was measured 24 h after inoculation and a 0.8 ml gas sample was used to determine CH_4 concentration by GC. Data were analyzed by a two-way ANOVA accounting for feed, water treatment and their interaction, using GLM procedure in SPSS.

Results Electromagnetic treated water did not effect (P>0.05) total gas production or methane output per gram DM incubated or DM digested in four contrasting livestock feeds over a 24 h period. As there was no effect (P>0.05) of electromagnetic treated water on the apparent DM disappearance of the feeds, rumen fermentation in general was also unaffected by the treatment.

Table 1 The impact of electromagnetic treated water on methanogenesis assessed using the *in vitro* total gas production technique

Treatment	Feed	TGP inc ml/g DM	CH_4 inc ml/g DM	TGP dig ml/g DM	CH_4 dig ml/g DM	CH_4 ml/ml TGP	aDMd g/g
Non-treated water	Grass	208	30.7	277	40.9	0.15	0.75
	Silage (S)	176	27.0	288	44.1	0.15	0.61
	Barley (B)	253	39.0	309	47.8	0.15	0.82
	S + B	198	35.6	278	49.9	0.18	0.71
EMF treated water	Grass	203	30.6	274	40.7	0.15	0.74
	Silage	172	27.9	258	46.1	0.16	0.68
	Barley	258	34.4	344	45.5	0.13	0.77
	S + B	206	34.4	285	47.7	0.17	0.72
Non-EMF water		209	33.1	288	45.7	0.16	0.72
EMF water		209	32.3	290	45.3	0.15	0.72
SEM	Treat. x diet	7.1	1.72	20.7	2.75	0.006	0.044
P	Treatment	NS	NS	NS	NS	NS	NS
	Diet	<0.0001	<0.0001	NS	NS	0.001	0.027

TGP inc/dig, total gas production ml per g DM incubated/digested; CH_4 inc/dig, ml of methane per g DM incubated/digested; aDMd, apparent dry matter disappearance. EMF, electromagnetic and magnetic fields. Not significant (NS), P>0.05. There were no significant treatment x diet interactions (P>0.05).

Conclusions Electromagnetic water treatment did not influence either total gas production or methane output in four contrasting livestock feeds. Assessing the effect of EMF treated water over a longer timeframe in a continuous culture assay may be worthwhile.

References

Colic, M. and Morse, D. 1998. Journal of Colloid and Interface Science. 200, 265-272.
Colic, M. and Morse, D. 1999. Colloids and Surfaces. A: Physiochemical and Engineering Aspects. 154, 167-174.

https://doi.org/10.1017/S2040470010004012 Published online by Cambridge University Press