Effect of biological additives (EU200® and BIO-BUSTER®) on the characteristics of cattle whole slurry and its liquid fraction during anaerobic storage

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Background

Biological processes are usually considered as an alternative to improve manure management due to their impact on the N, C and P cycles. A number of biological additives have been produced commercially and used widely by farmers for manure treatment all over the world. Although the mode of action of these additives are usually unknown, there is the need to test the efficacy of the additives to perform as claimed by the manufacturers in order to protect the interest of farmers and to provide information to help understand the mode of action of these additives. Recently, two new biological additives (EU 200® and Bio-buster®) have been produced and currently available on the market. The manufacturer of the additives claim the microbes present supersedes those originally in manure, because they are better adapted, ensures rapid degradation of organic materials and work best at slightly acidified conditions (pH 6).

Objective

To study the effect of the additives (EU 200® and Bio-buster®) on the characteristics and properties of cattle whole slurry and its liquid fraction during anaerobic storage .

Materials and methods

Each effluent type (cattle whole slurry and its liquid fraction) initially had 2 treatments, one with acidification (pH 6) and one without acidification (pH 8.0 for the whole slurry and pH 8.5 for the liquid fraction). The acidified and non-acidified effluents were further amended with 3 treatments each: control, Bio-buster® (BB) and EU200® (EU200). BB (a liquid formulation of enzymes and micro-organisms) was applied at a rate of 0.40 L m^{-3} effluent and EU200 (a powder formulation of micro-organisms) was applied at a rate of 0.17 kg m^{-3}. The experiment was repeated for 4 replicates making a total of 48 experimental units. The experiment was conducted at a constant temperature of 20° C for 105days.

Fig. 1 Experimental set up

Results

Fig. 2 Effect of the interaction between acidification and biological additives on the Total-N of effluents after 105 days of storage

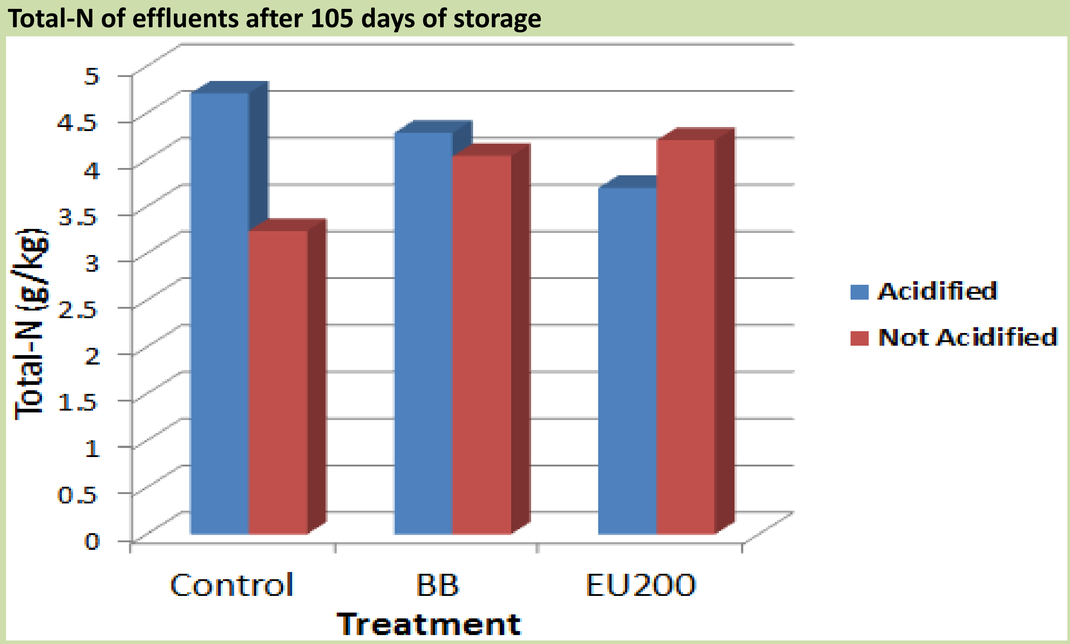

Fig. 3 Effect of biological additives on the pH of Effluents (Whole slurry and Liquid Fraction) after 105 days of storage

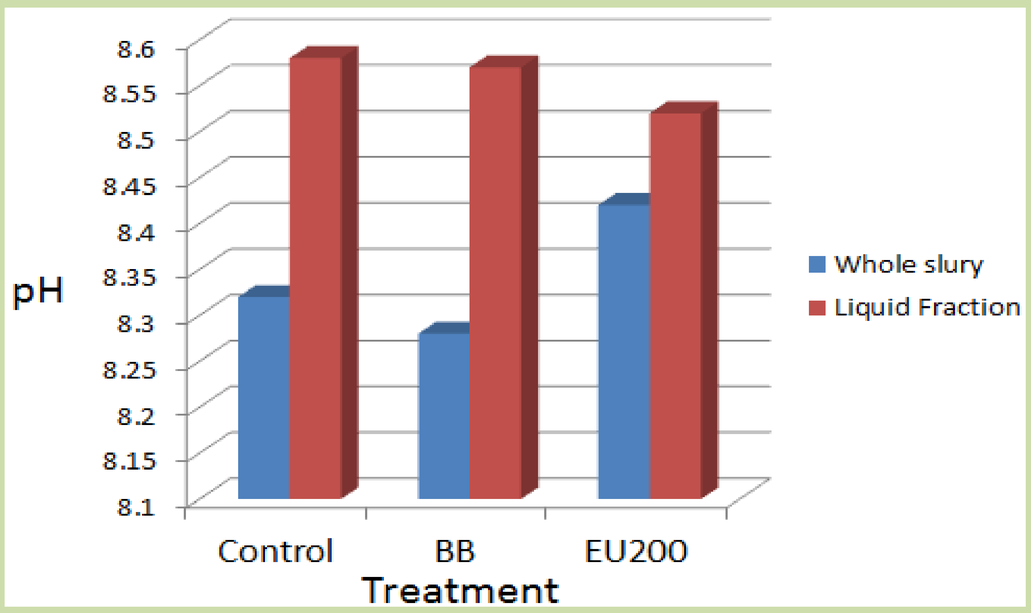

Fig.4 Effect of effluent type and acidification on the organic matter and fibre components of dry matter after 105 days of storage

Effluent	Acidification	Organic matter (% of DM)	Fibre (ash free) % of Dry matter (DM)		
			Total	Lignin	Hemicellulose+cellulose
Whole slurry	Acid	80.0^{a}	55.0^{a}	23.0^{a}	31.9^{a}
	No acid	77.0^{b}	48.0^{b}	24.0^{a}	23.1^{b}
Liquid fraction*	Acid	61.2^{c}	25.0^{c}	18.3^{b}	5.2^{c}
	No acid	61.0^{c}	24.0^{c}	19.5^{b}	3.1^{c}

*The liquid fraction was separated from the whole slurry by hand using 0.5mm sieve.
Different superscripts in the same column indicate significant differences at $p<0.05$ using the Bonferroni comparison of means test.

After 105 days, the use of biological additives showed a significant effect on the total-N but the result was reliant on the acidification factor ($p<0.01$). The highest total-N content (4.71 mg N kg^{-1}, average for both effluents) was observed when the materials were acidified and no biological additive was used. Although, when no acidification of the effluents were done, the application of BB and EU200 increased the total N-content of the effluents, respectively, by 25 and 30% compared to the Control (not acidified) as shown in Fig. 2

Relatively to the pH value results, a significant interaction ($p<0.05$). between the type of effluent and the addition of biological additives was observed. Addition of EU200 to the whole slurry leads to a higher pH value than BB as shown in Fig.3

With respect to the organic matter and fibre components, acidification of the effluents increased ($p<0.01$) the amount of organic matter and fibre components with the exception of lignin which remained unaffected as shown in Fig 4.

Conclusion

Eventhough, laboratory analysis of the samples are still on-going, two interesting observations have been made from the analysed results so far: 1. The type of effluent had a significant effect on the behaviour of biological additives at the end of storage and 2. The pH of effluents also had a significant effect on the performance of biological additives. This may suggest that, dry matter content and pH of effluents are important parameters to consider in understanding the mode of action of these additives. Furthermore, the use of biological additives did not have any effect on the organic matter and fibre components of effluents, at least after 105 days of storage.

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