Alternative additives to perform acidification and alkalinization of animal manure

S. Chrysanthopoulos[1*], E. Porotti[1], J. Coutinho[2], L. Brito[1], D. Fangueiro[1]

[1] Linking Landscape, Environment, Agriculture and Food Research Unit (LEAF), Terra associated laboratory Instituto Superior de Agronomia, Ulisboa, Tapada da Ajuda, 1349-017 Lisboa, Portugal. Electronic address: schrysanthopoulos@isa.ulisboa.pt

[2] Centro de Química, Universidade de Trás-os-Montes e Alto Douro, Quinta de Prados, 5000-801 Vila Real, Portugal

INTRODUCTION

- Animal manure is a nutrient rich material that can be used as a bio-based alternative to fertilize horticultural crops. Improper management at a farm scale and after field application has been associated with several environmental problems such as nutrient leaching to underground waterbodies and high GHGs and NH_3 emissions to the atmosphere[1].
- pH modification of animal slurry (liquid animal manure) is an efficient and cost-effective strategy to abate these issues. Past research studies have assessed acidification and/or alkalinization of animal slurry by utilizing chemical additives to achieve pH modification[2,3]. The present study explores the possibility to use agro-industrial by-products as slurry additives.

Figure 1: Samples of agro-industrial by-products. From left to right; Brewers spent grain (bio-acidification), Combination of dregs and grits (alkalinization) and grits (alkalinization)

RESULTS

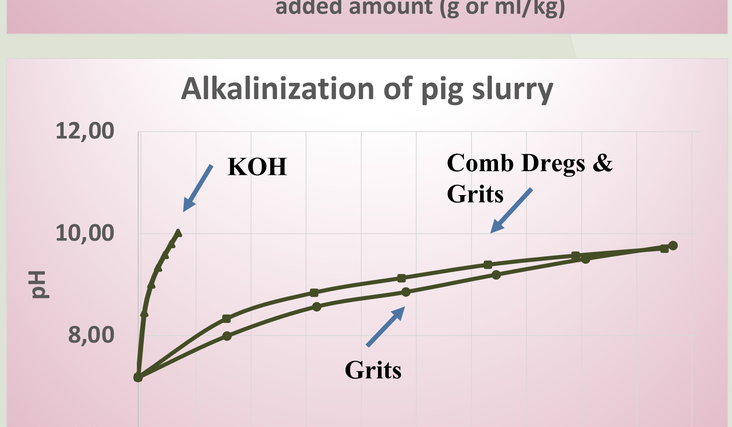


Figure 2: Acidification (top) and alkalinization (bottom) titration curves of the selected additives

- ✓ Acidification to pH 5 achieved with **spent acid** by applying **8,7ml**/Kg pig slurry whereas alkalinization to pH 9,5 with **grits and combination of dregs** and grits by using **81g**/Kg slurry.
- ✓ **Less foam formation** was observed during acidification with **spent acid** compared to **sulphuric acid**
- ✓ During the 30 days storage, there was **no considerable fluctuation in pH** for all the selected additives
- ✓ **Slurry hygienization** (<1000 CFU) was achieved with all selected additives

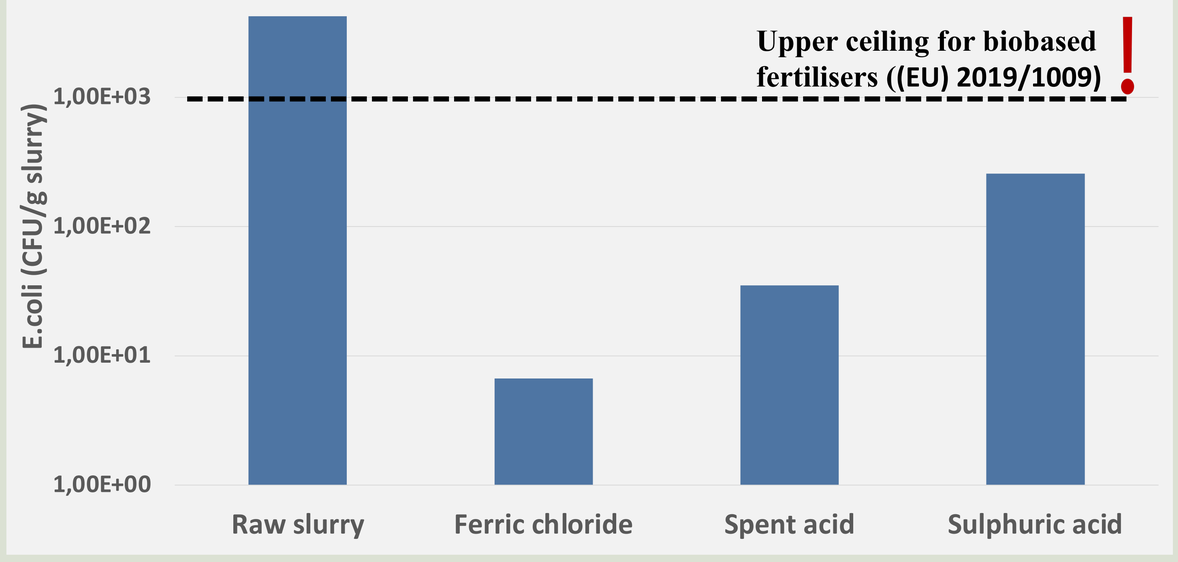


Figure 3: Determination of *E.coli* numbers (CFU/g slurry) in raw and acidified pig slurry with selected additives

OBJECTIVES & METHODOLOGY

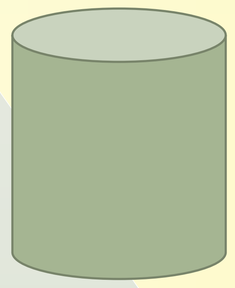
Three criteria applied to perform the selection of the most promising alternative additives

- Reach target pH; Acidification at pH 5 and alkalinization at pH 9,5
- Require less than 250ml or g/Kg slurry
- Maintain target pH during short-term storage

Pig slurry

Treatments & selected additives

Acidification	• Sulphuric acid (Reference treatment) • Ferric chloride • Spent acid (paper company)
Bio-acidification	• Table sugar (Reference treatment) • Brewers spent grain (Beer company)
Alkalinization	• Potassium hydroxide (Reference treatment) • Grits (paper company) • Combined dregs and grits (paper company)



Short-term storage (30 days)

Microbiological analysis; *E.coli* (CFU) and presence of *Salmonella*

Conclusions

- The selected alternative additives manage to **reach the target pH** and maintain that value during the short-term storage
- **Chemical** additives require **less amount** to reach target pH, however, the **industrial by-products** needed **less than 100ml** or g/Kg slurry except brewers spent grain.
- Further experiments are necessary to assess the impact of selected additives on nutrient availability and GHGs and NH_3 emissions

References

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