Supplementary information

Materials and methods

Physiochemical parameter analyses

The physiochemical characteristics of swine waste samples and raw materials were optimized on a dry weight basis using different methods. Collected swine waste was air-dried and analyzed for its physiochemical properties. The pH of all the treatments was measured by a pH meter (ORION STAR, A110 series, Thermo Scientific™, MA, USA). Volatile solids (VSs) were analyzed by combustion of the dried sample at 550℃ for 6 h. The total nitrogen (TN) was determined by the Kjeldahl method. The total organic carbon (TOC) was determined by the Walkley-Black method.

Results and discussion

Characteristics of raw materials before and after treatments

The physiochemical characteristics of the initial and final treatment were analyzed using different parameters, and these characteristics are given in Table S1. After 10 days in vitro, the MC, SW and SW + MC treatments significantly modified the properties. The initial pH was consistent with the optimal pH during the odour reduction treatment; later, the pH was affected, particular by the MC treatment, and the value varied from 7.50 to 8.80, while the SW powder masking treatment had no much effects (7.54 to 7.62). However, when the SW + MC treatment was used, the pH slightly increased from 7.45 to 8.94. A similar result was reported in poultry manure composting with microorganism inoculation, which showed that the manure pH started at 7.70 but increased to 9.20 in mature compost, producing products that are less alkaline than the initial manure. Zhong et al. (2017) studied dairy manure composting, where the pH started at 7.80, ranged from 7.80 to 9.0, and reached a terminal pH of 8.0. These studies suggest that the increase in manure pH variation could be due to the ammonification effect by microbe inclusion in the manure.

The total nitrogen (TN) ratio was reduced significantly in MC and SW + MC treated samples compared with the SW treated and control samples. The initial TN ratio range in the MC treated samples was 43911 ± 0.11 mg/L, and this concentration decreased to 3037 ± 0.51 mg/L in the final MC treated sample. The maximum reduction recorded was to 3001 ± 0.12 mg/L in the SW + MC treated samples, while an increase to 3217 ± 0.25 mg/L was recorded in the SW treated samples. In addition, the same type of difference in the extent of reduction was observed in the total phosphorous (TP) levels. The initial TP ratio range was 262.71 ± 0.54 mg/L in the control samples, and this range decreased to 111.84 ± 0.21 mg/L in the SW + MC-treated swine slurry and recorded as a maximum reduction, which was amended with 2% SW + MC. MC treatment was reduced to 203.85 ± 0.28 mg/L, and SW amended with 2% SW were found to be similar to control levels. Carbon contents are essential nutrients for energy production and microbial growth during the composting process. Compared with those of the control sample, the total organic carbon (TOC) contents were

significantly increased. Here, the initial TOC ratio ranges of the MC, SW and SW + MC-treated samples were 5210 ± 0.22, 5120 ± 0.04 and 5180 ± 0.11 mg/L, which increased to 6270 ± 0.46, 6645 ± 0.26 and 5900 ± 0.67 mg/L, respectively.

Table S1 Characteristics of the initial and final treatment

Parameters (Units)	Initial treatment				Final treatment			
	C	MC	SW	SW + MC	C	MC	SW	SW + MC
pH	7.09 ± 0.44	7.50 ± 0.25	7.54 ± 0.34	7.45 ± 0.21	7.10 ± 0.52	8.80 ± 0.32	7.62 ± 0.02	8.94 ± 0.52
TN (mg/L)	4511 ± 0.11	4391 ± 0.11	4033 ± 0.22	4201 ± 0.28	4012 ± 0.21	3037 ± 0.51	3217 ± 0.25	3001 ± 0.12
TP (mg/L)	153 ± 0.06	145 ± 0.12	142 ± 0.22	140 ± 0.15	262.71 ± 0.54	203.85 ± 0.28	262.98 ± 0.22	111.84 ± 0.21
TOC (mg/L)	5290 ± 0.22	5210 ± 0.04	5120 ± 0.11	5180 ± 0.22	6012 ± 0.14	6270 ± 0.46	6645 ± 0.26	5900 ± 0.67

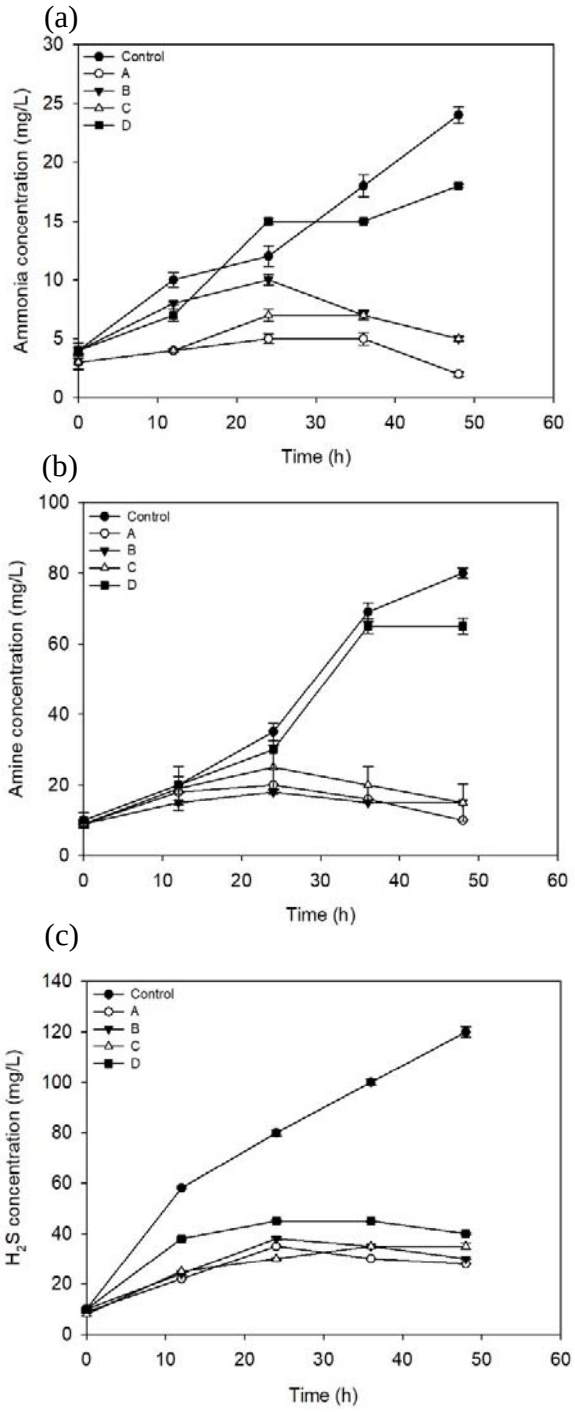

Fig. S1 Effect of applying *B. subtilis* + *S. cerevisiae* + *Thiobacillus* sp. at different ratios (A: 1.5% + 1.5% + 2%; B: 2% + 1.5% + 2%; C: 1.5% + 2% + 2%; and D: 2% + 2% + 2%) on odour reduction by decreasing (a) ammonia, (b) amine, (c) H_2S gases emitted by a swine slurry (500 mL) at 25℃

References

Zhong X Z, Ma S, Wang S P, Wang T, Sun Z Y, Tang Y Q, Deng Y, Kida K (2017). A comparative study of composting the solid fraction of dairy manure with or without bulking material: Performance and microbial community dynamics. Bioresource Technology, 247: 443–452