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The potential use of aquaculture pond sludge and fish waste to produce *Eisenia fetida* (Lumbricidae), Vermiwash: an approach towards sustainable aquaculture and fisheries industry of Sri Lanka

F. H. S. Madhusanki[1] and U. P. K. Epa[1*]

[1]Department of Zoology and Environmental Management, University of Kelaniya, Kelaniya, Sri Lanka
epa@kln.ac.lk *

Pond bottom sludge and fish waste are considered as major environmental pollutants in the aquaculture and fish processing industries and managing them are necessary to reduce their negative environmental impacts. In pond aquaculture practices, different amounts of nutrients are generated depending on the culture conditions and biological processes of fish and the environment. In the present study, aquaculture sludge and fish waste were used as bedding materials to produce vermiwash using *Eisenia fetida*. Under field conditions, vermiwash was prepared using three combinations of substrates, including (i) cow dung & *Gliricidia* leaves (control as industrial practice), (ii) cow dung & aquaculture sludge and (iii) cow dung & fish waste in a 2: 1 ratio and three replicates from each combination. *E. fetida* (250 earthworms per 6 kg of bedding materials) were introduced to each vermiwash preparation unit and fresh vermiwash samples were collected weekly after 15 days of introducing *E. fetida* to experimental units for four consecutive weeks. Chemical parameters including pH, conductivity, chemical oxygen demand (COD), total nitrogen (TN), orthophosphate (Ortho-P) and total potassium of vermiwash samples were measured. A germination test was conducted using *Phaseolus vulgaris* seeds with experimental vermiwash samples extracted in the fourth week. After three months, the number of earthworms in vermiwash units was counted to assess their survival ability. TN in aquaculture sludge vermiwash (0.22±0.20%) was comparatively higher than the fish waste (0.09±0.04%) and the control (0.16 ± 0.15%). However, TN among the control and treatment vermiwash solutions were not significantly different (P = 0.783). *P. vulgaris* seeds treated with aquaculture sludge vermiwash had the highest percentage of seed germination (63.3%). The germination of seeds (%) in the distilled water was 61.7% and 47.2 % in the control. The lowest seed germination was observed in the fish waste vermiwash (33.7%). The number of *E. fetida* in vermiwash preparation units of the control and aquaculture sludge increased by 49.2% and 33.3%, respectively, from the initial introduction. Higher mortality of *E. fetida* was observed in the fish waste vermiwash preparation, and only 9.2% of *E. fetida* survived at the end of the experiment. It can be concluded that, aquaculture sludge can successfully be used as a bedding material for vermiwash production as it supports the multiplication of *E. fetida* which also contains higher TN content and higher seed germination of *P. vulgaris*. Except for the low K level, aquaculture sludge vermiwash is chemically comparable with the control vermiwash. However, fish waste was not suitable to prepare vermiwash in the proportions tested in this study as *E. fetida* couldn't multiply and survive in this bedding material. The seed germination in fish waste vermiwash treated *P. vulgaris* seeds is also low. Aquaculture sludge can successfully be used as a bedding material for vermiwash production as it supports the multiplication of *E. fetida*, contains comparatively higher TN content and increases the seed germination (%) of *P. vulgaris*.

Keywords: Aquaculture sludge, *Eisenia fetida*, Fish waste, Vermiwash