# Pit additive

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A **pit additive** (or more accurately **pit or septic tanks additive**) is a commercial product which is intended to reduce sludge accumulation rate or to reduce odor and fly problems in pit latrines, septic tanks or wastewater treatment plants.[1]

There is little to no scientific evidence that shows that any of these commercial additives have the benefits claimed by the manufacturers.[2]

Pit additives are often, but not always, associated with the idea of "Effective Microorganisms" (EM).

## Contents



## Background

Pit additives are advocated for use in sanitation systems, in particular in pit latrines and septic tanks. The products, consisting of packaged micro-organisms or enzymes or both, are marketed for their ability to either reduce the pit or septic tank filling rate with fecal sludge, or to decrease material volumes.

It has been estimated that in the U.S. more than 1,200 septic system additives were available on the market in 2011.[3] However, very little peer-reviewed and replicated field research exists regarding the efficacy of biological septic tank additives.[3]

### Claimed benefits

Many claims for additives have been made such as increased sludge breakdown and decreased odor; this is supposedly due to certain nutrients being present in the commercial pit additives or certain aerobic micro-organisms being present or being encouraged to grow better.[2] Research, however, finds that these claims are unlikely to be true.[2][4] The quantity of bacteria introduced to the pit or septic tank by additives is insignificant compared to the number already present.[2]

## Septic tanks

Researchers from the U.S. carried out field experiments in 2011 to assess the effect of additives on the performance of 20 septic tanks.[3] These septic tanks served residences at a mobile home park located in Orange County, North Carolina were used in this study. The researchers distinguished between tanks that were well maintained, poorly maintained and maintained to an intermediate level, defining the level of maintenance in terms of the period since the septic tank had last been desludged (up to 2–3 years for well maintained, 15 – 20 years for poorly maintained and somewhere in between for the intermediate category). They found some reduction in sludge accumulation rates but only for their category of well-maintained septic tanks. A follow up study investigated the impact of three additives on the performance of well-maintained septic tanks. Overall, their conclusion was that there was limited evidence of additive impact on the performance of septic tanks. It should be stressed that these field experiments used additives other than EM (effective microorganisms) and some people might argue that the more varied composition of EM makes it more effective than the additives tested here.

The United States Environmental Protection Agency (USEPA) has produced a fact sheet on the use of additives to improve the performance of septic tank treatment systems.[5] The fact sheet concludes that biological additives such as bacteria and extracellular enzymes do not appear to significantly enhance normal biological decomposition processes in septic tanks. They go on to say that 'some biological additives have been found to degrade or dissipate septic tank scum and sludge. However, whether this relatively minor benefit is derived without compromising long-term viability of the soil infiltration system has not been demonstrated conclusively'. They noted that some studies suggest that material degraded by additives in the tank contributes to increased loadings of BOD, suspended solids, and other contaminants in the otherwise clarified septic tank effluent.

# Wastewater treatment plants

Proponents claim the additives in wastewater can facilitate reduction in organic load and pathogen removal, leading to significant improvements in effluent quality. They also claim benefits relating to the rate of sludge build-up and odor reduction. One source claims that septic tank additives can reduce hydrogen sulphide and ammonia production.[6] Their reasoning is that additives contain natural' organisms that prevail over the rather less 'natural' organisms that would otherwise dominate conditions in the treatment unit, whether this be a septic tank or some form of aerobic treatment. They even claim that by overcoming the effects of 'unnatural' substances such as bleach and other disinfectants, the use of septic tank additives allows septic tanks and other treatment systems to function in conditions that would otherwise have resulted in their becoming 'dead' and non-functional.

One short note claims that microorganisms in the additives contain various organic acids due to the presence of lactic acid bacteria. These secrete organic acids, enzymes antioxidants, and metallic chelates thus create an antioxidant environment, which assists in the enhancement of solid-liquid separation, which is the foundation for cleaning water.[7] The authors of the note provide no explanation of how this works.

However, the findings from various studies around the world indicate that:

- There is no reliable evidence that addition of pit additives to wastewater prior to treatment has a significant effect on pathogen concentrations.
- The evidence on the effect of pit additives on settleability of solids and reduction in effluent BOD and suspended solids is mixed. Under some circumstances, it appears that adding pit additives can have some effect on both BOD and SS concentrations but the effect is not large and is not proven.[1]
- The available evidence suggests that any lasting effect of pit additives is dependent on regular

application of the microorganisms combined with good maintenance of the treatment technology. This will require (a) a reliable supply chain for the pit additive and (b) management systems that ensure that the pit additive is added regularly and on schedule.

While it is possible that these kinds of pit additives can lead to some improvement in effluent quality, it is unlikely that the improvement obtained will be sufficient to allow effluent uses that would not have been possible if additives had not been used. In particular, it seems that any claim that they can make otherwise 'unsafe' effluents from primary and enhanced primary treatment process 'safe' is unlikely to be justified.

### Australia

Australian scientists investigated the effect of additives in a wastewater treatment plant and a number of septic tanks.[8] Their aim was to test the hypothesis that the additive reduces sludge volumes. They found significant reduction in pH levels at the wastewater treatment plant together with improved settlement of sludge but with a significant increase in organic matter (measured as biological oxygen demand). Their results for the septic tanks showed a homogenization of conditions in the tanks after application of septic tank additives, which they suggested was due to domination by a particular type of micro-organism. However, they found no reduction in suspended solids concentration in the effluent and concluded that there were not sufficient changes in sludge volume in the wastewater treatment plant or suspended solids in the septic tanks to indicate a clear benefit from the use of these kinds of additives in wastewater.

### Orangi Pilot Project in Karachi, Pakistan

A project in Karachi, Pakistan called the Orangi Pilot Project (OPP) has been making use of pit additives. The OPP promotes a treatment technology comprising a two-chamber tank. The first of these acts like the first compartment of a septic tank while the second is filled with gravel to provide filtration. It is not clear whether flow through the second compartment is upward or downward. This arrangement has some similarities to baffled reactor designs promoted by the German NGO BORDA, although standard BORDA designs provide more chambers, arranged in series and with all after the first chamber operating in an upward flow mode. The baffled reactor design is one of a number of 'DEWATS' (decentralised wastewater treatment systems) wastewater treatment technologies promoted by BORDA. All operate anaerobically and are examples of what might be termed enhanced primary treatment. If maintained well, enhanced primary treatment modules should perform better than a well maintained conventional septic tank but will still produce an effluent with high pathogen levels and relatively high biological oxygen demand and suspended solids concentrations.

The OPP is using the additives to improve the effluent produced at these small treatment plants, including the plant that treats effluent from a nursery in Karachi. It has also supported the installation of several small treatment plants using EM technology in rural Sindh and Punjab. Its partner organization Ali Hasan Mangi Memorial Trust (AHMMT) installed a small sewage treatment unit with additives to treat sewage from 300 houses in the village Khairodero in Larkana District. Another eleven are reported to be functioning and more are planned.[9]

During discussions at the Urban Resource Centre in Karachi in late 2011, the late Parveen Rehman of OPP stated that adding pit additives to the inlet chamber of these treatment facilities had resulted in improved effluent quality and a significant reduction in smell. However, it seems that OPP had not attempted to quantify the improvement and had not made any formal assessment of the effect of the pit additive on effluent quality.

## Cost

Based on the research conducted so far, it is fair to say that individuals and local authorities spending money on such additives for their sanitation systems are generally wasting their money.[2] A fifth of South African municipalities indicated in 2011 that they purchased various additives as part of their sanitation management programmes. However, the Water Research Commission in South Africa advocates against this practice, stating that the money would be better spent on effective pit sludge management through improved pit emptying methods and improved pit design, or by use of movable top structures or low flush toilets with alternating leach pits.[10]

As the costs and health risks associated with manual pit emptying are significant, if a product was ever developed which significantly impacted the filling rate of pits, e.g. based on EM, this would be of enormous significance.[2]

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