

Mushroom Technology Literature Review

Abstract

Over 2.5 billion people do not have safe and dignified toilet. Piped water sewage systems are not viable in remote, dry, and rapidly developing areas. The waste substrate remaining after growing mushrooms can be added to dry toilets and pit latrines to control smell and treat the waste.

Background

This project builds on the masters research conducted by (Urieli, 2016) where *Pleurotus* fungi was used to control the smell of human faeces. Further unpublished results indicate that *Pleurotus* inhibit *E. coli* bacteria. This raises the possibility of *Pleurotus* being used as a novel sanitation treatment method.

The key pathogen groups in sanitation treatment are bacteria, viruses, protozoa and helminths (Strande, Ronteltap, & Brdjanovic, 2014). (Andersson et al., 2003; Šnajdr & Baldrian, 2006) show that fungi have a negative effect on bacteria populations, more specifically (Oyetayo & Ariyo, 2013) has shown that *Pleurotus ostreatus* could completely inhibit a range of bacteria. A variety of fungi decrease the viability of Helminth eggs (Blaszkowska, Wojcik, Kurnatowski, & Szwabe, 2013; Larsen, 1999), in particular *Pleurotus pulmonarius* exerts a strong immobilising effect on preinfective larvae of animal parasitic nematodes (Larsen & Nansen, 1991). Despite a lack of literature on the ability of *Pleurotus* spp. to control viruses and protozoa, the literature indicates *Pleurotus* spp. as a promising candidate for use in sanitation treatment.

With an estimated 1.5 billion people using pit latrines worldwide (WHO & UNICEF, 2014), *Pleurotus* could be used as a low-tech, distributed, insitu sanitation treatment. Currently pit latrines contaminate the local environment and are hazardous to empty. A *Pleurotus* additive for pit latrines could remove the malodour rendering the additive marketable as a "Smell Stopper". The additive would also decrease or remove the pathogens in the waste, making the waste easier or safe to handle and dispose of in the local environment. A *Pleurotus* additive could be easily distributed as it is safe, extensively researched, and widely available due to its use as a food source (Cohen, Persky, & Hadar, 2002).

80% of the mushroom mass produced during food production is the waste mycelium that cannot be sold as food. Spent *Pleurotus* substrate is a widely available waste that has already been shown to:

- Purify water by reducing phenol content and toxicity in olive mill waste (Martirani, Giardina, Marzullo, & Sannia, 1996)
- Purify soil to remove biocide pentachlorophenol (Chiu, Ching, Fong, & Moore, 1998)
- Fertilise lettuce seedlings leading to increased yields (Marques et al., 2014)
- Produce lignocellulosic enzymes for industrial applications (Phan & Sabaratnam, 2012)
- As a foodstuff for a variety of livestock (Rinker, 2002)
- A general soil supplement (Rinker, 2002)
- Combined with fresh substrate and re-inoculated (Rinker, 2002)
- Biogas production (Rinker, 2002)

Further Research

The first area of research is need to confirm that *Pleurotus* spp. are better at pathogen reduction than other candidates such as *Stropharia* used in mycofiltration (Taylor, Flatt, Wolff, Brownson, & Stamets, 2015) or Coprophilous fungi such as *Coprinopsis cinerea*, that grown in faeces and are known to excrete antibacterial substances (Essig et al., 2014).

The extent of the pathogen reduction is another question. *Pleurotus* will produce a local inhibition of bacteria (Oyetayo & Ariyo, 2013), it will need to found whether this is extends throughout the pit latrine. Not all Helminth eggs are rendered non-viable by *Pleurotus* (Larsen & Nansen, 1991), the degree of successful treatment will need to be accessed. Finally the effect of *Pleurotus* on protozoa and viruses is unknown.

Citations

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