

## Bioremediation of PCP by *Trichoderma* and *Cunninghamella* Strains Isolated from Sawdust

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### ABSTRACT

Four fungal isolates, SD12, SD14, SD19 and SD20 isolated from the aged sawdust grew on agar plates supplemented with PCP up to a concentration of 100 mg L<sup>-1</sup>. At high PCP concentration, isolate SD12 showed the highest radial growth rate of 10 mm day<sup>-1</sup>, followed by SD14 and SD19 both with 4.5 mm day<sup>-1</sup> and SD20 with 4.2 mm day<sup>-1</sup>. Ultrastructural study on the effect of PCP on the PCP tolerant fungi using scanning electron microscope showed that high concentration of PCP caused the collapse of both fungal hyphae and spores. Among the four PCP tolerant fungi examined, isolate SD12 showed the least structural damage at high PCP concentration of 100 mg L<sup>-1</sup>. This fungal isolate was further characterized and identified as *Cunninghamella* sp. UMAS SD12. Preliminary PCP biodegradation trial performed in liquid minimal medium supplemented with 20 mg L<sup>-1</sup> of PCP using *Cunninghamella* sp. UMAS SD12 showed that the degradation up to 51.7% of PCP in 15 days under static growth condition.

**Key words:** Pentachlorophenol, Fungi, *Cunninghamella* sp., Scanning Electron Microscopy, PCP degradation

### INTRODUCTION

Pentachlorophenol (PCP) is a widespread, persistent environmental contaminant that has been, and in some developing countries still is one of the extensively used fungicides and pesticides, especially in wood preservation (McAllister et al. 1996; Ge et al. 2007). PCP has been classified as a priority pollutant by the U.S. Environmental Protection Agency (Keith and Teillard 1979) and has been banned for all usage in certain countries such as India, New Zealand, Sweden and Germany (Ge et al. 2007). Despite being banned and restricted in certain countries due to its toxic effect on health and environment, PCP still remains an important pesticide from a toxicological perspective (Proudfoot 2003). PCP is very toxic. Short term exposure to high level of PCP can cause damage to the central nervous system, while

long term exposure, especially for workers in the wood preserving industries can cause serious damage to the liver and kidney (Fisher 1991). PCP is also a possible carcinogen to human (IARC 1999). Dermal exposure to PCP by sawmill workers has been associated with the cases of non-Hodgkin's lymphoma, multiple myeloma, kidney cancer and also with a number of physical and neuropsychological health effects in former sawmill workers that persisted long after PCP exposure had ceased (Demers et al. 2006; McLean et al. 2009).

The highest reported usage of PCP is in the wood preserving and treatment industry, where PCP has been widely used to protect the utility poles, cross arms, construction lumber, fence post and many other wood related products from fungal rots, decay and staining by sapstain fungi (Tuomela et al. 1999). The use of PCP in dip treatment of

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