

# Impacts of Pentachlorophenol (PCP) on Coral Reefs: Disruption of Coral-Symbiodiniaceae Symbiosis and Induction of Coral Bleaching in *Porites lutea* and *Montipora digitata*

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## Abstract

Stress from chemical pollutants is among the key issues that adversely impact coral reefs. Pentachlorophenol (PCP) is widely found in coastal environments with a variety of adverse effects, and its potential impact on coral reef ecosystems is of concern. The scleractinian corals *Porites lutea* and *Montipora digitata* were used for the PCP exposure experiments in this study. Phenotype, physiological indicators, high-throughput sequencing, and RNA sequencing were used to investigate the response mechanisms of corals to PCP exposure. *P. lutea* and *M. digitata* showed bleaching after 96 hours of acute exposure at 1000 µg/L PCP, with a decrease in Symbiodiniaceae density, Fv/Fm, and chlorophyll a content. They also showed bleaching after long-term exposure to 0.1 µg/L PCP, and Fv/Fm decreased significantly to 0.481 and 0.461, respectively. Microbial community analysis revealed an increase in pathogenic bacteria such as *Citrobacter* and *Vibrio* during acute exposure, and the emergence of *Delftia* in *M. digitata* during long-term exposure. Transcriptomic analyses indicated abnormal carbohydrate and amino acid metabolism in zooxanthellae, disrupting the symbiotic relationship and triggering immune responses in the host. The toxic responses of PCP on both zooxanthellae and their host were further confirmed by the upregulation of differential metabolites and differential proteomes in *P. lutea*. These results indicate that PCP exposure might affect the balance of coral-zooxanthellae symbiosis in stony corals, impairing coral health and leading to coral bleaching.

## Keywords

Pentachlorophenol, *Porites Lutea*, *Montipora Digitata*, Coral Bleaching, Pathogenic Bacteria, Immune Responses