Investigation of Different Degradation Treatments on Pesticide Contaminated Water with Toxicity Bioassay on Daphnia magna

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Pesticides help to ensure crop productivity, but they contaminate the surrounding environment with toxic substances that can directly affect a local ecosystem's organisms. Microbial degradation of pesticides occurs naturally, but with today's higher levels of pesticide usage, toxic pesticides persist longer in the environment and can run-off or leach into human water systems. In this experiment, I measured the effectiveness of several degradation techniques at degrading a wide variety of pesticides. Fifteen types of organophosphate pesticides were degraded using UV light (254 nm) photolysis, potassium permanganate, hydrogen peroxide and combined treatments. I applied the UV light photolysis treatment method for six days with measurements being taken on each day using a GC/MS/MS. Concentration levels for nine out of the 15 pesticides dropped to non-detectable amounts, and the other six dropped by over 83%. The other treatments using hydrogen peroxide and potassium permanganate yielded drops of 54-83% and 59-100% for all pesticides, respectively. After combining pesticide degradation treatments, I found that the chromatogram peaks of all pesticides dropped over 93% for the hydrogen peroxide/UV combination and over 94% for the permanganate/UV combination. In addition, a water safety test using Daphnia magna has been conducted for 6-hour durations. The UV treatment and the combined permanganate/UV treatment resulted in a higher surviving Daphnia magna count and thus better water quality. However, the combined hydrogen peroxide/UV treatment resulted in higher toxicity levels for Daphnia magna. These results indicate that pesticide degradation can be achieved through a variety of treatments and combining these treatments greatly improve pesticide degradation.

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