The Effects of the Pesticide Atrazine on the Biomass of Phytoplankton and its Impacts on Watershed Regions

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Abstract

Atrazine is the most commonly used pesticide in the U.S. to resist weeds of corn, sorghum, and sugarcane crops. More importantly, atrazine contamination of ground and surface waters has generated a second evaluation by the Environmental Protection Agency. Our experiment tests the effects of three concentrations of atrazine, including the allowed EPA concentration for drinking water of 3µg/L, on the biomass of phytoplankton.

Introduction

Atrazine (2-chloroo-4-ethylamino-6-isopropylamino-s-triazine) is the most widely used ingredient in pesticides in America today, yet its true effects are being highly debated. After application of pesticides to weeds, atrazine has been shown to disrupt photosynthesis by inhibiting photosystem II (DeNoyelles et. al.). Manufacturers of pesticides and other products containing Atrazine have scientists currently investigating the matter; while the U.S. Environmental Protection Agency launched a new program in 2009. According to an EPA press release on Oct. 7, 2009 the agency set out to determine the true effects of the pesticide on aquatic environments. The results of these studies may come with great economic loss to many of the leading manufacturers of these everyday products.

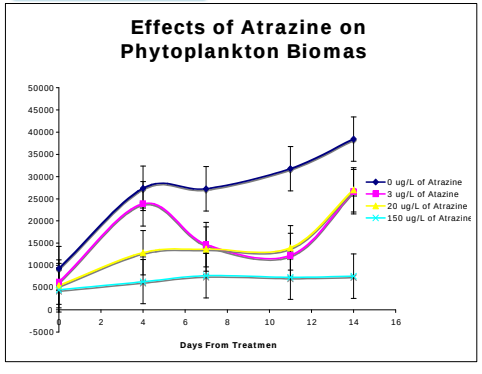
Currently the maximum contaminant level for drinking water is 3 ug/L. The maximum reported wet deposition for atrazine is 154 ug/L from Iowa precipitation. Atrazine is also relatively mobile, regularly entering water through runoff, and concentrations in surface waters often peak after rains (Rohr et al.). According to DeNoyelles et al., atrazine has been detected in many natural waters in concentrations between 0.1ug/L and 30 ug/L. This study determines the effects of atrazine in watershed aquatic environments by measuring how the drug affects Phytoplankton biomass.

Questions

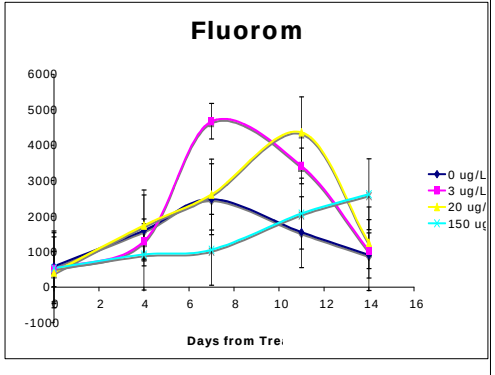
1) To evaluate the variances in biomass caused by differing concentrations of Atrazine

2) To relate these effects to watershed regions

Results



Graph 1 (above) shows the relationship between varying concentrations of Atrazine and Phytoplankton biomass based on the averaged samples of each group given by cell count. (0ug/L- R2 = 0.8606; 3ug/L- R2 = 0.3079; 20ug/L- R2 = 0.7926; 150ug/L- R2 = 0.7308)



Graph 2 (above) shows the levels of Chl-a fluorescence for Phytoplankton in relation to the averaged samples of each group treated with Atrazine

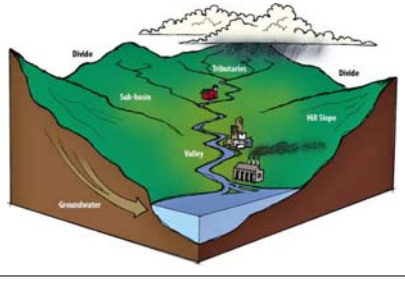


Figure 1 (left) is an image of a typical watershed region. It illustrates how runoff is typically transported to coastal water after agricultural lands are treated with pesticides such as Atrazine

Methods

- Phytoplankton were acquired from Grice Marine Laboratory at the College of Charleston and distributed into twelve 300ml culture flasks
- The twelve samples were divided into four categories; Groups A, B, C and D
- Each group then received 225uL of solution containing Atrazine
  - Group A- 0ug/L; Group B- 3ug/L; Group C- 20ug/L; Group D- 150ug/L
- Samples were housed in an incubator, receiving twelve hours of artificial light and twelve hours of darkness
- Fluormetric analysis and cell counts were performed twice a week for a period of three weeks

Conclusion

Our cell count data supports the hypothesis that Atrazine effects Phytoplankton growth. With the highest concentration of Atrazine, Group D had the slowest growth rate followed by Group C, B then A, each with successively lower concentrations of the pesticide. Seven days after treatment with Atrazine, Group B showed a decrease in biomass. This drop in cell count concentration can most likely be attributed to sampling error. Prior to sampling, culture flasks were not mixed to create a homogenous solution.

This same procedural error is likely to have caused the deviation in our fluorometric analysis. The non-homogenous solutions were filtered and did not account for settled Phytoplankton in the culture flasks. After the filtering of samples, the cell counts were taken from a more homogenous solution due to mixing that occurred from pouring.

The effects evident in Graph 1 suggest that Atrazine contamination in watersheds from runoff is harmful to the primary production in that region.

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