Drying effects on mineral surface catalyzed atrazine degradation

Adrian R. Adams¹, Catherine E. Clarke¹, Alakendra N. Roychoudhury²

¹ 1. Department of Soil Science; 2. Department of Earth Sciences, Stellenbosch University, Private Bag X1, Matieland, 7602, Stellenbosch, South Africa. cdowding@sun.ac.za

Drying, a popular herbicide, endocrine disruptor and possible carcinogen, is frequently detected in water systems. Its biodegradation is well known, but its degradation by soil mineral catalysis is relatively poorly understood. Furthermore, climate change could increase instances of extreme soil drying through evaporation (affects several soil reactions) in the future. Therefore, the degradation of atrazine on the drying surfaces of oxide and clay mineral catalysts was investigated. The effects of using various catalysts as well as the drying rate (using birnessite – most efficient catalyst) was studied. A possible reaction mechanism is also discussed.

Effect of different catalysts – drying vs. moist

Starting composition: left to react for 14 days

Effect of drying rate

Ambient drying

Rapid drying under N₂

Rapid drying under compressed air

Summary and conclusions

- Drying significantly increases degradation.
- Surface redox potential plays a role, but reaction is not non-redox (no extra Mn⁴⁺ produced), O₂ plays no role either.
- Degradation initiates at RM ~ 10%.
- Increased drying rate – increased degradation rate.
- Applicable to agricultural soils – windrowing and tilling can cause extreme drying.

Possible reaction mechanism

- Extreme drying – extreme acidity

- Apparent redox potential control – degradation follows Mn⁴⁺ > Fe³⁺ >> Al³⁺ and Si⁴⁺ – electrons move within M–N

Effect of drying rate

Normalized recovery (%)

Remaining moisture, RM (%)

Drying is initiated when remaining moisture reaches 10%

Mechanical information

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Works cited: