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▶ **To cite this version:**

Caroline Michel, Nicole Baran, Laurent André, Catherine Joulian. Impact of pesticides on denitrification in groundwaters. 1st International Conference on Microbial Ecotoxicology. Ecotoxicomic 2017, Nov 2017, Lyon, France. 2017. hal-01586077

HAL Id: hal-01586077
https://brgm.hal.science/hal-01586077

Submitted on 12 Sep 2017

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Impact of pesticides on denitrification in groundwaters

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Abstract

Denitrification processes are involved in the decrease of nitrate (NO3-) concentrations in groundwaters impacted by human activities. Non-target/side effects of pesticides on soil microbial denitrification have been demonstrated. It is however now well established that groundwater is an ecosystem in itself with specific microbial communities different from soils' ones. If the impact of pesticides on groundwater bacterial communities has already been studed, the impact of pesticides on the denitrification activity in groundwater has still to be investigated. Groundwater samples are collected from several wells on a catchment submitted to agricultural practices with fertilizers and pesticides uses. Groundwaters contain nitrate (lower than limit of quantification up to 80 mg/l), pesticides and some of their metabolites in low concentrations. The abundance of genes involved in denitrification (*narG*, *napA*, *nirS*) shows the occurrence of bacteria able to perform, at least, the two first steps of denitrification. Three groundwaters distributed within the catchment and exhibiting different denitrification signatures based on genes identification and physic-chemical properties are selected. They are used in laboratory to perform batch experiments in conditions boosting microbial denitrification (addition of KNO3 and acetate, anaerobic conditions, 25∘C). The microbial ecotoxicology study is conducted in the presence or absence of pesticides spiked as single or cocktail pesticides. Several parameters (pH, concentrations of acetate, NO3, NO2, N2O, biomass) are recorded over time to quantify denitrification rate according to experimental conditions. This experimental work constitutes a first step in the understanding of the inhibitor/catalyzer role of pesticides on denitrification process.

Keywords: denitrification, groundwater microbial community, pesticides, side effects

*Speaker