

Tagungsnummer

P37

Thema

Kommission VI: Bodenschutz und Bodentechnologie

Schicksal, Wechselwirkungen und Wirkung von bodenfremden Stoffen im Boden

Autoren

I. Mulder¹, J. Siemens¹, V. Sentek², W. Amelung², K. Smalla³, S. Jechalke³

¹Universität Giessen, Institut für Bodenkunde und Bodenerhaltung, Giessen; ²Universität Bonn, Institut für Nutzpflanzenwissenschaften und Ressourcenschutz, Bonn; ³Julius Kühn-Institut, Institut für Epidemiologie und Pathogendiagnostik, Braunschweig

Titel

Sequestration of quaternary ammonium compounds in soil and its relevance for the proliferation of antibiotic resistance in the environment

Abstract

Quaternary ammonium compounds (QACs) are a group of surface-active, biocidal, high production volume chemicals. In the agricultural sector, their applications are especially broad and range from disinfectants and detergents in animal husbandry to their use as adjuvants in pesticide formulations. Inputs of QACs into agroecosystems are potentially high where manures, sewage sludge or wastewater are applied to the farmer's fields for nutrient recycling. The presence of QACs in the environment has frequently been implicated in the co-selection for antibiotic resistance genes (ARGs) with unforeseeable risks for environmental and human health [1]–[3]. The selection of ARGs depends on concentrations of QACs in bio-accessible form and the persistence of these compounds. However, a comprehensive overview on i) predicted & measured concentrations of QACs in soils including their analysis, ii) mechanisms of their sequestration in soils based on their physicochemical and structural properties, and iii) the implications of the concentrations and the fate of QACs in soils for the proliferation of ARGs in the environment is missing. Based on a review of these topics, we propose that QACs are sequestered in the interlayer regions of clay minerals in soils, which reduces their acute toxicity, but increases their persistence. The slow release of QACs from the interlayer regions may maintain concentrations levels in soil solution that are large enough to co-select for antibiotic resistant soil bacteria promoting the proliferation of ARGs in the environment.

Literatur

- [1] Jennings et al. "Quaternary ammonium compounds: an antimicrobial mainstay and platform for innovation to address bacterial resistance," *ACS Infect. Dis.*, vol. 1, no. 7, pp. 288-303, Jul. 2015.
- [2] Tandukar et al., "Long-term exposure to benzalkonium chloride disinfectants results in change of microbial community structure and increased antimicrobial resistance," *Environ. Sci. Technol.*, vol. 47, no. 17, pp. 9730-9738, Sep. 2013.
- [3] Gaze et al., "Impacts of anthropogenic activity on the ecology of class 1 integrons and integron-associated genes in the environment," *ISME J.*, vol. 5, no. 8, pp. 1253-1261, Aug. 2011.