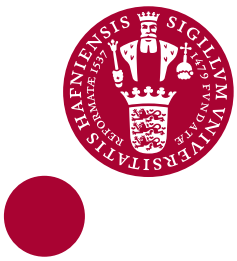

Accelerated bacterial adaptation to sulfadiazine in hotspot soil environments

Brandt, Kristian Koefoed; Sjøholm, Ole Rüdiger; Krogh, Kristine Andersen; Halling-Sørensen, Bent; Nybroe, Ole

Published in:
Book of Abstracts

Publication date:
2008

Document version
Publisher's PDF, also known as Version of record

Commission II, together with Commissions I and III of the DBG

Workshop

Fate and Effects of Pharmaceuticals in Soil

held at the Gustav-Stresemann-Institute, Bonn, Germany

September 30 - October 02 2008

Jointly organized by W. Amelung, University of Bonn &

S. Thiele-Bruhn, University of Trier

on behalf of the Research Group FOR 566

"Veterinary Medicines in Soil: Basic Research for Risk Analysis"

Supported by DFG and DBG

Accelerated bacterial adaptation to sulfadiazine in hotspot soil environments

Kristian K. Brandt[1], Ole R. Sjøholm[1], Kristine Andersen Krogh[2], Bent Halling-Sørensen[2] and Ole Nybroe[1]

Sulfadiazine (SDZ) constitutes an important emerging pollutant in both aquatic and terrestrial environments and may increase environmental reservoirs of antibiotic resistance. Our aim was to compare two cultivation-independent methods for determination of bacterial community tolerance to antibiotics and to investigate the adaptation of soil microbial communities in bulk soil and hotspot soil with elevated substrate loading. Replicated laboratory-incubated soil microcosms were set up with an agricultural soil with different levels of SDZ (0-100 μg g^{-1}) and two levels of weekly substrate loadings (0 and 125 μg C g^{-1}; synthetic root exudates). Community tolerance to SDZ could not be reliably determined using flow cytometry viability probing (CFDA esterase assay), as even high SDZ exposure levels (400 mg l^{-1}) used for community tolerance detection did not have any significant impact on the frequency of esterase-positive cells. By contrast, bacterial community tolerance could reliably be determined by the 3H-leucine incorporation technique. Community tolerance developed quickly with no major differences in tolerance levels observed in soils exposed to one, two or three repeated SDZ soil amendments at monthly intervals. Bacterial community tolerance increased progressively with elevated SDZ exposure ($P < 0.001$) and was significantly increased in hotspot soil as compared to bulk soil ($P < 0.001$). Primary SDZ degradation and ^{14}C-SDZ mineralization data also showed an increased adaptation of SDZ degraders in hotspot soils. Collectively, our results indicate that future studies of the soil microbial resistome should be directed to soil microenvironments with increased substrate availability such as rhizosphere and manure-soil interphases.

[1]Department of Agriculture and Ecology, Faculty of Life Sciences, University of Copenhagen, Thorvaldsensvej 40, DK-1871 Frederiksberg
Telephone: +45 35332612
Fax: +45 35332606
E-mail: kkb@life.ku.dk

[2]Department of Pharmaceutics and Analytical Chemistry, Faculty of Pharmaceutical Sciences, University of Copenhagen, Universitetsparken 2, DK-2100 Copenhagen, Denmark.