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Testing the applicability of rapid on-site enzymatic activity detection for surface water monitoring

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On-site detection of enzymatic activities has been suggested as a rapid surrogate for microbiological pollution monitoring of water resources (e.g. using glucuronidases, galactosidases, esterases). Due to the possible short measuring intervals enzymatic methods have high potential as near-real time water quality monitoring tools.

This presentation describes results from a long termed field test. For twelve months, two ColiMinder devices (Vienna Water Monitoring, Austria) for on-site determination of enzymatic activity were tested for stream water monitoring at the experimental catchment HOAL (Hydrological Open Air Laboratory, Center for Water Resource Systems, Vienna University of Technology). The devices were overall able to follow and reflect the diverse hydrological and microbiological conditions of the monitored stream during the test period. Continuous data in high temporal resolution captured the course of enzymatic activity in stream water during diverse rainfall events. The method also proofed sensitive enough to determine diurnal fluctuations of enzymatic activity in stream water during dry periods. The method was able to capture a seasonal trend of enzymatic activity in stream water that matches the results gained from Colilert18 analysis for E. coli and coliform bacteria of monthly grab samples. Furthermore the comparison of ColiMinder data with measurements gained at the same test site with devices using the same method but having different construction design (BACTcontrol, microLAN) showed consistent measuring results. Comparative analysis showed significant differences between measured enzymatic activity (modified fishman units and pmol/min/100ml) and cultivation based analyses (most probable number, colony forming unit). Methods of enzymatic activity measures are capable to detect ideally the enzymatic activity caused by all active target bacteria members, including VBNC (viable but nonculturable) while cultivation based methods cannot detect VBNC bacteria. Therefore the applicability of on-site enzymatic activity determination as a direct surrogate or proxy parameter for microbiological standard assays and quantification of fecal indicator bacteria (FIB) concentration could not be approved and further research in this field is necessary.

Presently we conclude that rapid on-site detection of enzymatic activity is applicable for surface water monitoring and that it constitutes a complementary on-site monitoring parameter with high potential. Selection of the type of measured enzymatic activities has to be done on a catchment-specific basis and further work is needed to learn more about its detailed information characteristics in different habitats. The accomplishment of this method detecting continuous data of enzymatic activity in high temporal resolution caused by a target bacterial member is on the way of becoming a powerful tool for water quality monitoring, health related water quality- and early warning requirements.