

A consortium of anaerobic microorganisms protects metal sheet piles against corrosion

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Metal sheet piles are widely used in flood protection, dike construction and river bank reinforcement. Their corrosion leads to gradual deterioration and often makes early replacement necessary. Natural microbial corrosion protective layers (CPLs) can minimize corrosion damage and extend sheet pile life span. However, little is known about the mechanisms underlying microbial CPL formation. Therefore we wanted to characterize the microbial communities of CPLs. We used Illumina MiSeq technology to obtain the complete metagenomic diversity of the CPLs and correlated sediment parameters and organic matter content with microbial diversity.

The investigated microbial CPLs showed enrichment of *Methanobacteriaceae*, Coriobacteriales and Syntrophobacterales compared to bulk sediment. Methane-producing *Methanobacter* species can metabolize iron which initially leads to mild corrosion but could stimulate the formation of a carbonate-rich deposit layer on the long term. The high relative abundance of Coriobacteriales in our dataset underscores their potential role in metal corrosion protection.

By combining microbial diversity analyses with environmental physicochemical parameters we could reconstruct the microbial community composition and the metabolic potential of the microbial CPLs. Our study provides valuable insights into the microbial diversity of CPLs and enables the development of novel strategies for *in situ* screening of metal sheet piles.