GREEN INHIBITORS AGAINST $CaCO_3$ SCALE DEPOSITS – ON-SITE ASSESSMENT AND TUNING IN TUNNEL DRAINAGES

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Calcium carbonate scale deposits ($CaCO_3$ mineral formation from aqueous solution) in groundwater drainage systems are a common and challenging issue, especially if deposition and clogging limit the continuous water transport. The mechanical or chemical removal of such unwanted mineral deposits is highly cost and labor intensive arguing for optimized case-specific and sustainable prevention strategies. In the present study, a novel approach to prevent tunnel drainages from $CaCO_3$ scale formation was assessed on-site in two selected Austrian road tunnels: The eco-friendly green inhibitor polyaspartate (PASP) was tested and evaluated in order to significantly reduce and modify the (micro)structure and material consistency of the widespread $CaCO_3$ scale deposits. The application of minor amounts of PASP caused (i) a significant inhibition of $CaCO_3$ precipitation, (ii) a more porous or even loose consistency (calcareous mud) of the $CaCO_3$ deposits, and (iii) a shift in $CaCO_3$ mineralogy from predominant calcite toward metastable aragonite and frequent vaterite formation. Even a very low PASP concentration (few mg PASP L^{-1}) induced a strongly elevated saturation index of calcite up to ~2, i.e. close to the saturation level of ACC (amorphous Ca-carbonate). The upper reasonable dosage level of PASP has to be adjusted by considering the local inhibition requirements and regulative limits, as well as the case-specific microbial activity enabling the consumption of PASP, e.g. by the common iron metabolizing microbial species *Leptothrix ochracea*, which can reduce the effective PASP concentration and thus the anticipated inhibition effect.