Design of acrylated epoxidized soybean oil biobased photo-curable formulations for 3D printing

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Carbon sequestration uncertainties: bridging the model-data gap for enhanced weathering

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Enhanced weathering (EW) is a promising strategy for sequestering CO_2 by amending cropland and forest soils with crushed silicate materials. However, current model-based estimates suffer from numerous uncertainties resulting from the incomplete representation of the weathering process in soils and a lack of model-data comparisons. Here, we address this gap by improving and validating an ecohydrological and biogeochemical soil model that captures the EW dynamics in the upper soil layers. We present a systematic model-experiment comparison leveraging four experiments with different degrees of complexity, ranging from simple closed incubation systems to fully open mesocosm experiments. The comparison reveals an encouraging observation-model agreement for the primary variables of interest, such as rock alkalinity release and CO_2 sequestration. The comparison also demonstrates that the weathering rates consistently fall below those of flask dissolution experiments, underlining the need to update mineral weathering rate formulations in soils. As measurements from field trials become available, further model-data comparisons will help refine the model in support of large-scale EW deployments.