Kaolinite fines dissolution using benign organic acids

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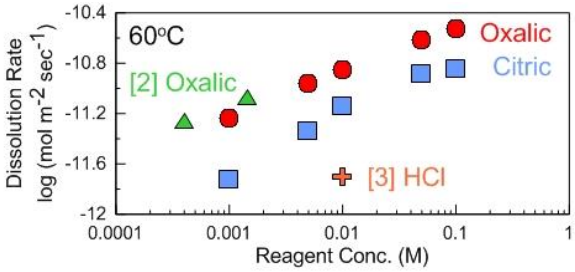
Fine migration, a form of formation damage, leads to the impairment of reservoir permeability due to the mobilisation of fine particles such as clay minerals [1]. Current treatment strategies involve the use of mud acids, a mixture of hydrochloric and hydrofluoric acids, often found to be damaging to well equipment and harmful to the environment. This study aims to identify an environmentally benign treatment strategy capable of dissolving kaolinite ($Al_2Si_2O_5(OH)_4$), a migratory fine clay mineral and leading cause of formation damage.

Low defect Georgia kaolinite (KGa-1b) was reacted in fixed volume batch reactor vessels at 60°C using a range of oxalic and citric acid concentrations (0.001 to 0.100 M) buffering at pH 4. Samples were collected every 1-3 days and filtered after inverting the vessel to resuspend clay particles. Samples were analysed for their Si and Al concentrations using ICP-OES, BET surface analysis conducted and grain size distribution evaluated using µ-CT imaging.

Results show congruent Al/Si dissolution and extend on previous studies using oxalic acid [2]. 0.100 M oxalic acid was identified as the best treatment strategy with dissolution rates an order of magnitude greater than HCl at pH 2 (See figure below) [3].



Experiments underway will analyse for the change in reactive surface area during batch experiments measured by BET, µ-CT and SEM imaging. The treatment strategy will also be applied in core-flood experiments to assess its feasibility under reservoir conditions.

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