CHEMICAL OXIDANT STIMULATION Of COAL SEAMS To INCREASE COAL SEAM PERMEABILITY

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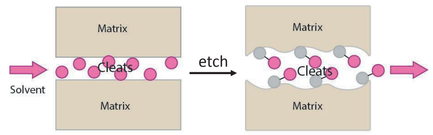
Research Question:

Can the permeability of a coal seam be enhanced by using an in-situ oxidant treatment?

Objectives:

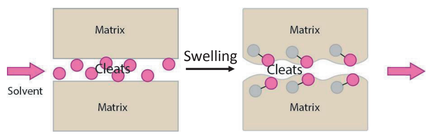
- Investigate effects of various oxidizing chemicals on the coal permeability;
- Develop a fundamental understanding of the oxidizing mechanisms;
- Rank the different chemical treatments and identify those offering the most promise for particular coals.

Possible effects of oxidants:



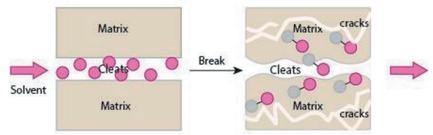
(1) Schematic for coal etching

Coal cleat surface could be etched, leading to an increase in cleat aperture. Expectation: Increase in permeability.



(2) Schematic for coal swelling

The oxidant molecules could penetrate into the coal structure and swell the coal internally, leading to a decrease in cleat aperture. Expectation: Decrease in permeability

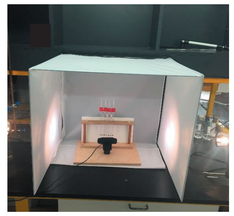


(3) Schematic for coal breakage

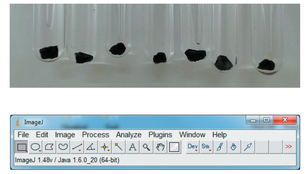
Coal breakage could occur, possibly preceded by coal swelling. Expectation: Increase or decrease in permeability.

Methodology: Swell/shrink test

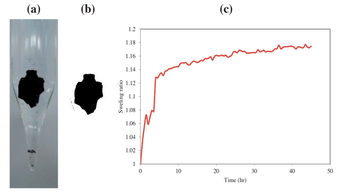
- Identify coal particle size change
- Visualize coal oxidation process



1. Camera Observation



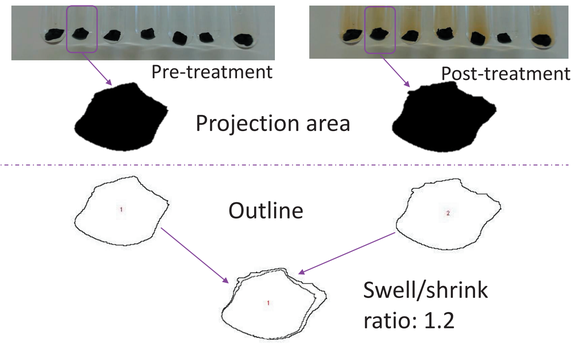
2. Image Analysis

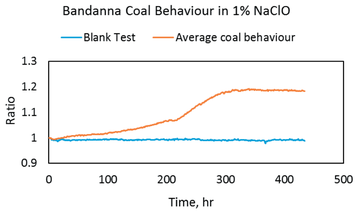


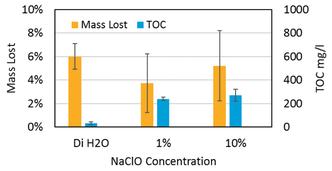
3. Results Generation

Results:

➢ NaClO

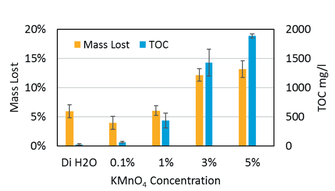






➢ $KMnO_4$

Coal Sample		Rank	$KMnO_4$ Concentration					
Source	Name	R_O (%)	0.015%	0.03%	0.1%	1%	3%	5%
Bowen Basin	NC2	0.85	1.01	1.02	1.02	1.08	Breaking	Breaking



- Increasing $KMnO_4$ concentration causes increased swelling until a threshold of breakage
- Particle breakage means new pathways may be generated under confining condition.

Conclusion:

1. NaClO and $KMnO_4$ react with the Bandanna coal, causing swelling and breakage.
2. Increasing oxidant concentration causes increased swelling.

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