

Effect of fines migration on oil recovery from carbonate rocks

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Appendix A: Properties of injection fluids

Table A-1: Composition and concentration of injected brine

Brine	Chemical formula of each salt used in the injection fluid	Concentration of salt (mol/L)				
		undiluted brine	3x diluted brine	6x diluted brine	12x diluted brine	distilled water
Seawater	KCl	0.011	0.0037	0.0018	0.0009	0
	MgCl ₂ ·6H ₂ O	0.03	0.0100	0.0050	0.0025	
	Na ₂ SO ₄	0.034	0.0113	0.0057	0.0028	
	CaCl ₂	0.012	0.0040	0.0020	0.0010	
	NaCl	0.54	0.1800	0.0900	0.0450	
	Total	0.63	0.21	0.07	0.05	
CaCl ₂	CaCl ₂	0.63	0.21	0.07	0.05	0

Table A-2: Properties of injected seawater

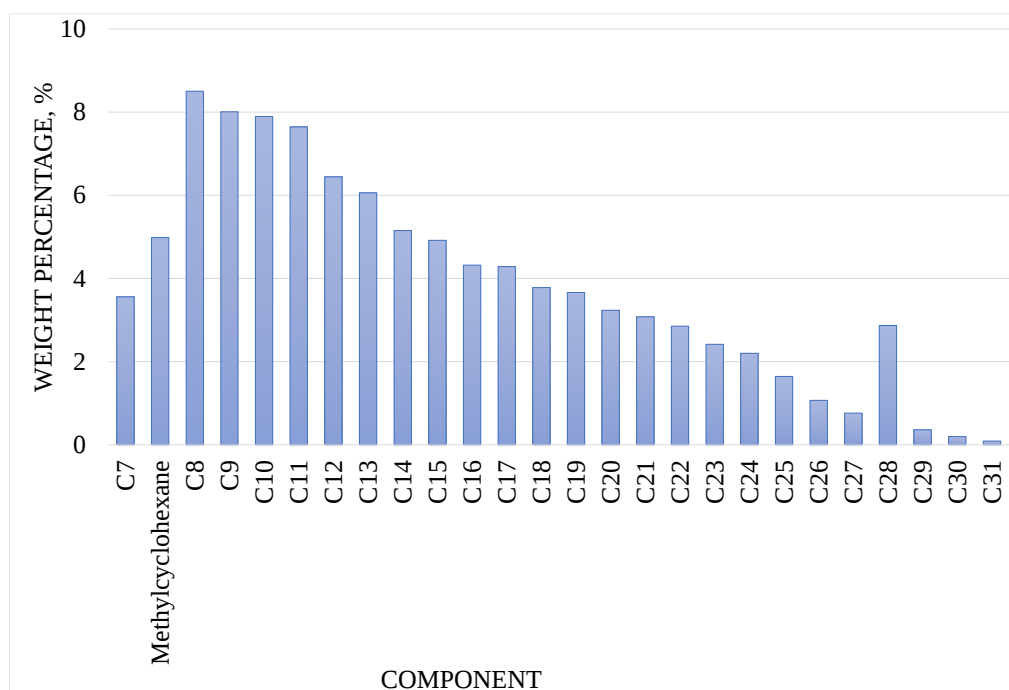
Injection fluid	Salinity (mol/L)	Density at 25°C (g/cm ³)	Viscosity at 25°C (cP)	pH at 25°C
Undiluted brine	0.63	1.03	1.048	5.52
3x diluted brine	0.21	1.01	0.982	5.56
6x diluted brine	0.10	1.00	0.968	5.57
12x diluted brine	0.05	0.999	0.968	5.57
Distilled water	0.00	0.997	0.892	6.63

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Table A-3: Properties of injected CaCl₂ brine

Injection fluid	Salinity (mol/L)	Density at 25°C (g/cm ³)	Viscosity at 25°C (cP)	pH at 25°C
Undiluted brine	0.63	1.049	1.043	5.81
3x diluted brine	0.21	1.014	0.934	5.86
6x diluted brine	0.10	1.01	0.912	5.84
12x diluted brine	0.05	1	0.902	5.82
Distilled water	0.00	0.997	0.892	6.63

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Figure A-1: Composition of crude oil.

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Table A-4: Properties of injected oils

Injection fluid	Density at 25°C (g/cm ³)	Viscosity at 25°C (cP)	IFT between oil and brine (mN/m)
Soltrol® 130	0.752	1.39	38
Crude oil	0.779	1.89	25

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Appendix B: Drainage results

Figure B-1 gives for each two-phase experimental run, the pressure difference between each rock sample's inlet and outlet during oil injection and the water recovery. Oil injection was stopped after about 21 of PV were injected and no more water was produced.

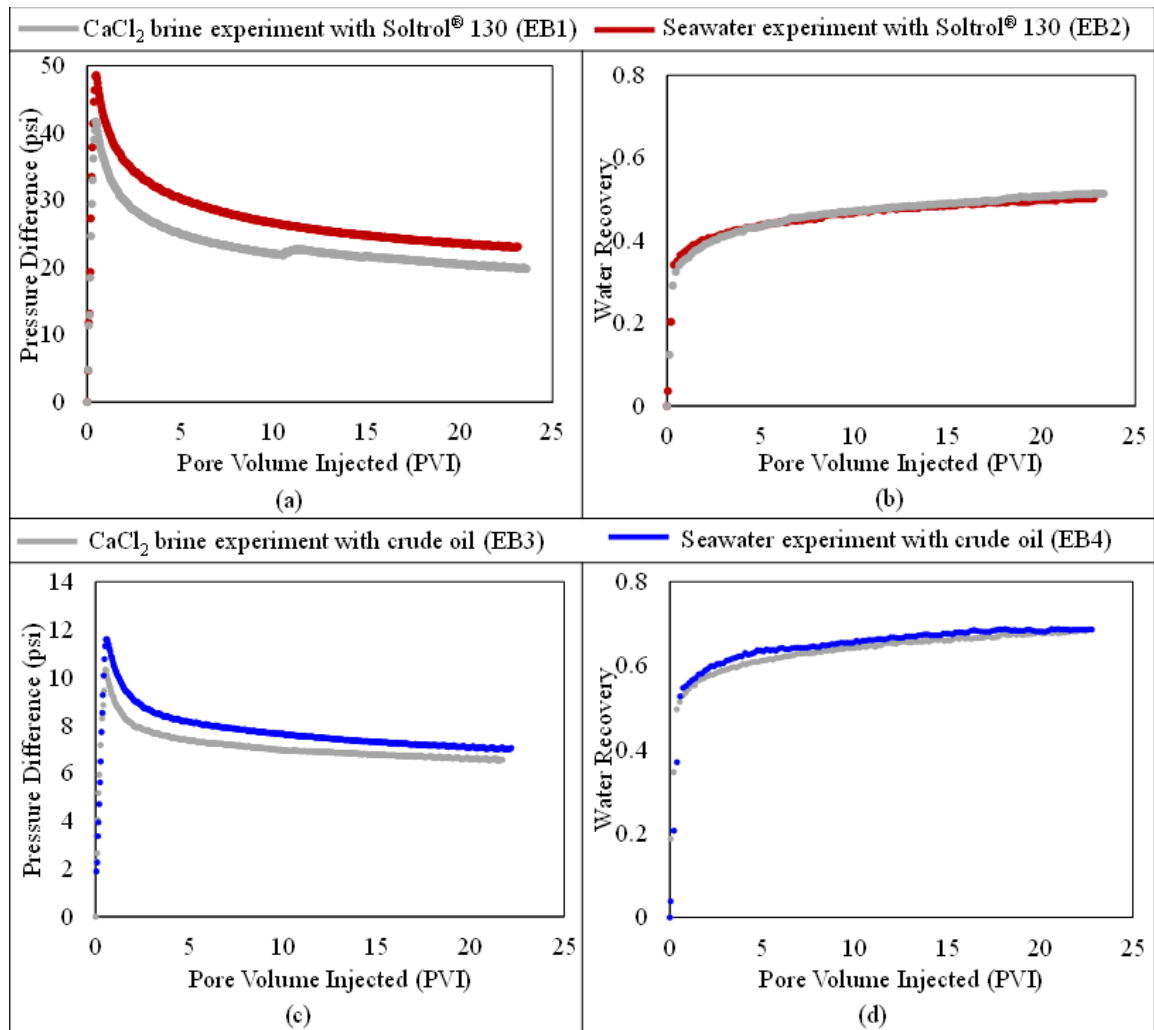


Figure B-1: Results for each two-phase experimental run: (a) pressure difference for EB1 and EB2, (b) water recovery for EB1 and EB2, (c) pressure difference for EB3 and EB4, and (d) water recovery for EB3 and EB4.