

FREEZE-THAW EFFECTS ON THE PERMEABILITY OF ORGANOCCLAY[®] REACTIVE CORE MAT[®]

Introduction

Previously, a series of laboratory tests were conducted on a bulk sample of CETCO organoclay which was exposed to freeze-thaw cycling. The results showed that there was no detrimental impact on organoclay particle size distribution (PSD), oil removal capability or permeability (see TR-803). A new study was undertaken to examine the effect of freeze-thaw cycling on the permeability of organoclay in a Reactive Core Mat (RCM).

Project Objective

The objective of this study is to investigate the impact of freeze-thaw conditions on the hydraulic performance of organoclay RCM.

Material

A Reactive Core Mat (RCM) with 0.8 lb/ft² of CETCO PM-199 organoclay was selected for this study and shipped to J&L Laboratory, an independent laboratory, for testing.

Freeze-Thaw Procedure

The organoclay RCM was fully wetted. The organoclay RCM was then transferred to a freezer with temperature of -24 °C overnight. The next day the organoclay RCM was removed from the freezer and allowed to thaw completely at 21 °C. The organoclay RCM underwent this freeze-thaw cycling for a total of 10 times before any further analytical tests was conducted.

Permeability Tests

Two permeability tests were performed on the organoclay RCM sample using ASTM test method D2434. First, the initial permeability of the organoclay RCM was tested. Then the permeability of the organoclay RCM subjected to the 10 freeze-thaw cycles was tested.

Results

The report by J&L Laboratory on the permeability testing of the organoclay RCM is presented in Appendix A. The initial permeability of the organoclay RCM and the permeability of the organoclay RCM that had undergone freeze-thaw cycling were both 0.17 cm/sec.

Conclusions

The stated conditions of freeze-thaw cycling had no impact on the permeability of organoclay RCM. Based upon previous work and this study, CETCO PM-199 organoclay supplied either in bulk or in RCM is expected to maintain hydraulic performance even when subjected to multiple freeze-thaw cycles.

APPENDIX A

J&L Laboratory Report

PERMITTIVITY / PERMEABILITY OF ORGANOCLAY RCM
CONSTANT HEAD METHOD
ASTM D-4491 / D-2434



Initial Test Prior to Freeze-Thaw Cycles

Client: CETCO
Project: Freeze-Thaw Permeability Test
Material: Organoclay RCM
Sample ID: Lot: 200542CV Roll 1
Manufacturer: CETCO

Job No.: 05LR719.02
Date Tested: 11/04/05
Technician: AG
Machine: JLT-CHPTV-1
Chk'd By : JB

HEAD ACROSS SPECIMEN: 5.08 cm
WATER TEMPERATURE: 19.2 Degrees C

SAMP. AREA: 44.096 cm²
TEMP CORR. 1.021

COUPON	REPLICATE	FLOW cm ³	TIME sec	THICKNESS mils (avg)	FLOW gal/min/ft ²	PERMITTIVITY sec-1	PERMEABILITY cm/sec
A	1	576.0	31.06	698.0	6.3	0.085	1.50E-001
	2	568.0	31.02	698.0	6.2	0.083	1.48E-001
	3	593.0	32.63	698.0	6.2	0.083	1.47E-001
	4	567.0	31.07	698.0	6.2	0.083	1.47E-001
	5	587.0	31.90	698.0	6.3	0.084	1.49E-001
B	1	669.0	31.53	686.0	7.2	0.097	1.69E-001
	2	658.0	31.18	686.0	7.2	0.096	1.68E-001
	3	625.0	30.06	686.0	7.1	0.095	1.65E-001
	4	627.0	30.33	686.0	7.1	0.094	1.64E-001
	5	621.0	30.28	686.0	7.0	0.093	1.63E-001
C	1	798.0	29.47	659.0	9.2	0.123	2.07E-001
	2	791.0	29.37	659.0	9.2	0.123	2.05E-001
	3	799.0	29.69	659.0	9.2	0.123	2.05E-001
	4	771.0	28.93	659.0	9.1	0.121	2.03E-001
	5	752.0	28.35	659.0	9.0	0.121	2.02E-001
D	1	713.0	29.93	708.0	8.1	0.109	1.95E-001
	2	719.0	30.40	708.0	8.1	0.108	1.94E-001
	3	722.0	30.59	708.0	8.1	0.108	1.93E-001
	4	694.0	29.50	708.0	8.0	0.107	1.93E-001
	5	703.0	29.87	708.0	8.0	0.107	1.93E-001

	UNITS	A	B	C	D	COMBINED
AVERAGE PERMITTIVITY	sec-1	0.084	0.095	0.122	0.108	0.102
AVERAGE FLOW	gal/min/ft ²	6.25	7.12	9.15	8.06	7.64
AVERAGE PERMEABILITY	cm/sec	0.15	0.17	0.20	0.19	0.17



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PERMITTIVITY / PERMEABILITY OF ORGANOCLAY RCM
CONSTANT HEAD METHOD
ASTM D-4491 / D-2434



Test After 10 Freeze-Thaw Cycles

Client: CETCO	Job No.: 05LR719.02
Project: Freeze-Thaw Permeability Test	Date Tested: 11/18/05
Material: Organoclay RCM	Technician: AG
Sample ID: Lot: 200542CV Roll 1	Machine: JLT-CHPTV-1
Manufacturer: CETCO	Chk'd By : JB
Freeze-Thaw Range: -24 degrees C to + 21 degrees C	

HEAD ACROSS SPECIMEN: 5.08 cm	SAMP. AREA: 44.096 cm ²
WATER TEMPERATURE: 19.0 Degrees C	TEMP CORR. 1.025

COUPON	REPLICATE	FLOW cm ³	TIME sec	THICKNESS mils (avg)	FLOW gal/min/ft ²	PERMITTIVITY sec-1	PERMEABILITY cm/sec
A	1	804.0	40.59	714.0	6.8	0.091	1.64E-001
	2	802.0	40.68	714.0	6.8	0.090	1.64E-001
	3	808.0	41.83	714.0	6.6	0.088	1.60E-001
	4	792.0	40.16	714.0	6.8	0.090	1.64E-001
	5	816.0	41.88	714.0	6.7	0.089	1.62E-001
B	1	799.0	40.51	648.0	6.8	0.090	1.49E-001
	2	797.0	40.71	648.0	6.7	0.090	1.47E-001
	3	793.0	40.89	648.0	6.6	0.089	1.46E-001
	4	789.0	40.61	648.0	6.7	0.089	1.46E-001
	5	821.0	42.31	648.0	6.6	0.089	1.46E-001
C	1	1037.0	40.31	675.0	8.8	0.118	2.02E-001
	2	1041.0	40.76	675.0	8.7	0.117	2.00E-001
	3	1029.0	40.35	675.0	8.7	0.117	2.00E-001
	4	1032.0	40.31	675.0	8.8	0.117	2.01E-001
	5	1049.0	41.00	675.0	8.8	0.117	2.01E-001
D	1	897.0	40.16	728.0	7.6	0.102	1.89E-001
	2	892.0	40.27	728.0	7.6	0.101	1.87E-001
	3	886.0	40.10	728.0	7.6	0.101	1.87E-001
	4	888.0	40.19	728.0	7.6	0.101	1.87E-001
	5	891.0	40.16	728.0	7.6	0.102	1.88E-001

	UNITS	A	B	C	D	COMBINED
AVERAGE PERMITTIVITY	sec-1	0.090	0.089	0.117	0.101	0.099
AVERAGE FLOW	gal/min/ft ²	6.72	6.68	8.76	7.59	7.44
AVERAGE PERMEABILITY	cm/sec	0.16	0.15	0.20	0.19	0.17



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