PROTECTO 401™'S ABILITY TO PROTECT DUCTILE IRON FROM ACID ATTACK

Induron has included independent test data concerning the growth of Acidithiobacillus Bacteria on the Protecto 401™ Ceramic Epoxy lining of ductile iron pipe and fittings. The growth of this bacteria contributes to the erosion of ferrous metals and concrete in sewer service, since this bacteria produces sulfuric acid as a waste product when it consumes hydrogen sulfide.

It is our opinion, based upon ASTM G 22 90 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Bacteria, that Protecto 401™ Ceramic Epoxy is not only an excellent barrier coat with zero permeability and resistance to high percentages of both bases and acids, but also a non-ablative (non-sacrificing) bactericide—which dramatically reduces the growth of thiobacillus bacteria, the main culprit in damage to sewer lines.

Because Protecto 401™ Ceramic Epoxy is constructed to produce a lining that has a higher ph throughout the lining and acidithiobacillus have to have an acid environment to flourish then Protecto 401™ Ceramic Epoxy acts as a bactericide without any loss of film integrity. The proof is in the testing. (see attached) The bare metal grows acidithiobacillus, when subjected to the warm moist climate and inoculated with the bacteria, at an alarming rate.

Protecto 401™ Ceramic Epoxy (which is referred to as the Black Epoxy Coupons in the test data), limits growth to only traces.

This added advantage—plus the unique construction of Protecto 401™ Ceramic Epoxy—is the reason for the longevity of Protecto 401™ Ceramic Epoxy in sewer service on ductile iron pipe and fittings.

Microbe Inotech Laboratories, Inc.
Summary Report of Analysis
[MILB –5554A]

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July 3, 2008

Description and Chain of Custody Record Information:

- Thursday, May 29, 2008 – 4:20PM: Received by Fed Ex, four (4) types of metal coupons (20 Black epoxy coupons, 20 Red epoxy coupons, 20 Tan epoxy coupons, and 20 blank coupons, total of 80 coupons) for a biodegradability study using *Acidithiobacillus ferrooxidans*.
- MILB Report & Invoice Number: 5554A (down payment) and 5554B (remaining balance).
- Proposal Option #3

Sample Processing:

- ASTM G22 90 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Bacteria.
- **Test Setup:** A metal coupon was placed on top of sterile water agar. The coupon was then inoculated with 1 mL of *Acidithiobacillus ferrooxidans* in growth media. This process was repeated 12 times for each coupon type. The replicates were then placed at 30°C for growth.
- **Controls:** Four (4) coupons were placed on sterile water agar and were not inoculated. These replicates were placed at 30°C. Four (4) additional squares of ribbon were placed on sterile water agar and were inoculated with sterile *Acidithiobacillus ferrooxidans* media. These replicates were placed at 30°C
- **Observations for Growth:** Observations for growth were made at 7 days from inoculation. The following ratings were used for the observations:

Observed Growth on Specimens	Rating
None	0
Traces of growth (less then 10%)	1
Light growth (10-30%)	2
Medium growth (30-60%)	3
Heavy growth (60%-complete coverage)	4

Results

Data: Aerobic Growth Results		
	Replicate	7 Day
Coupon coated in Black Epoxy	1	1
	2	1
	3	1
	4	1
	5	1
	6	1
	7	1
	8	1
	9	1
	10	1
	11	1
	12	1
Average Aerobic		**1**
Media Control	1	0
	2	0
	3	0
	4	0
Average Media Control		**0**
Negative Control	1	0
	2	0
	3	0
	4	0
Average Negative Control		**0**

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Data: Aerobic Growth Results		
	Replicate	7 Day
Coupon without epoxy coat	1	4
	2	4
	3	4
	4	4
	5	4
	6	4
	7	4
	8	4
	9	4
	10	4
	11	4
	12	4
	13	4
	14	4
	15	4
	16	4
Average Aerobic		**4**
Media Control	1	3
	2	2
Average Media Control		**2.5**
Negative Control	1	0
	2	0
Average Negative Control		**0**

Thank you from the staff on project:

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