FINAL REPORT

PROTOCOL
ISO Method 27447 – Test for Antimicrobial Activity
of Photocatalytic Materials (modified)

PRODUCT TESTED
Antimicrobial Photocatalytic Coatings
FN®Coating FN NANO®2 & FN NANO®3 & UV Light
Project Number NV2019.01

EMSL ORDER NUMBER
152003719

TESTING LABORATORY
EMSL Analytical, Inc.
5950 Fairbanks North Houston Rd.
Houston TX 77040
Phone: (713) 686-3635
Web: www.emsl.com

SPONSOR
Dominion Environmental Consultants, Inc.
150 North Durango Drive
Suite 190
Las Vegas, NV 89145

STUDY START DATE
June 17, 2020

STUDY COMPLETION DATE
July 29, 2020

Certificate of Analysis

Client: Dominion Environmental Consultants, Inc.

Contact: Benjamin Bojda

Project: Efficacy Testing of Photocatalytic coatings using 375nm UV-Light and Traditional Fluorescent Lighting.

EMSL NO: 152003719

Product: FN®Coating FN NANO®2 & FN NANO®3 photocatalytic coatings & UV Light – Project Number: NV2019.01

Samples received: 06/17/2020

Report date: 07/29/2020

Challenge Bacteria:
Methicillin-Resistant *Staphylococcus aureus* (MRSA) (ATCC 33592)
Escherichia coli (ATCC 25922)
Salmonella enterica (ATCC 1045)

Experimental Summary:
The testing procedure was designed after discussions between EMSL Analytical, the testing company, and the client, Dominion Environmental Consultants, Inc. The testing procedure follows ISO 27447 with minor modifications requested by the client for their specific product (as detailed below in the method). The testing was conducted on a photocatalytic coating.

Test Method:

Culture preparation: One loop of preserved MRSA (ATCC 33592), *E. coli* (ATCC 25922) and *S. enterica* (ATCC1045) were first plated separately onto tryptic soy agar supplemented with sheep blood (TSAB) and incubated at 35°C for 24 hours. A well isolated colony was transferred into tryptic soy broth (TSB) and incubated for 20 hours at 35°C. One loop of the test bacteria was transferred and plated onto TSAB. Two loops of well-isolated colonies were then harvested, suspended in 20 mL of 1/500 TSB. This suspension was diluted with 1/500 TSB and adjusted to ~ $10X10^6$ CFU/mL.

Inoculation of test material: Dominion Environmental Consultants, Inc. submitted two coatings for testing with photocatalytic properties (FN®Coating FN

NANO®2 & FN NANO®3). Thin, even coatings were applied to glass slides. The samples were prepared for evaluation by brush coating slides.

Individual test and control samples were placed in 47-mm sterile Petri dishes. Each test sample was inoculated with 100 µL of bacterial suspension as prepared above. Polystyrene film was cut to fit on the slides and spread the inoculum across the surface. Simultaneously, the control non-coated autoclaved slides were similarly prepared and inoculated. All test samples were incubated at 25°C with 8 hours with UV light on or with no lighting. All tests were performed in triplicate.

To determine the starting population, a 0.1 mL aliquot of the bacterial suspension was placed into 9.9 mL of sterile dilution water. A 1-mL aliquot of this solution was then taken and serially diluted. Dilutions were plated onto aerobic plate count Petrifilm plates to determine starting inoculum populations.

Recovery of test organism: The following exposure time points were evaluated: 0 (instantaneous) and 8 hours. After treatment, both test and the control samples were removed and then placed in centrifuge tubes with 20 mL of DE neutralizing broth. The tubes were vortexed for one minute to recover any remaining into suspensions. The suspensions were then serially diluted and plated onto aerobic plate count Petrifilm plates. These plates were incubated at 35ºC for 24-48 hours before colonies were counted.

Experimental Results:

Table 1. Efficacy of photocatalytic coatings against MRSA following 8 hour light treatment compared to untreated control (T=8 hr) population counts.

Treatment	CFU per sample (avg of 3)	Log CFU	Log Reduction	Percent Reduction
Lab control Time 0	20,000,000	7.30		
Lab control Time 8 hr	1,100,000	6.04	1.26	94.5
FN2 – no UV control 8 hr	5,600	3.75	2.29	99.5
FN2 – UV 8 hr	1,900	3.27	2.77	99.8
FN3 – no UV control 8 hr	48,000	4.68	1.36	95.7
FN3 – UV 8 hr	18,000	4.26	1.78	98.3

Table 2. Efficacy of photocatalytic coatings against *E. coli* following 8 hour light treatment compared to untreated control (T=8 hr) population counts.

Treatment	CFU per sample (avg of 3)	Log CFU	Log Reduction	Percent Reduction
Lab control Time 0	21,600,000	7.34		
Lab control Time 8 hr	1,800,000	6.25	1.08	91.7
FN2 – no UV control 8 hr	930	2.97	3.28	99.9
FN2 – UV 8 hr	125	2.10	4.16	99.99
FN3 – no UV control 8 hr	3,500	3.54	2.71	99.8
FN3 – UV 8 hr	600	2.78	3.48	99.97

Table 3. Efficacy of photocatalytic coatings against *S. enterica* following 8 hour light treatment compared to untreated control (T=8 hr) population counts.

Treatment	CFU per sample (avg of 3)	Log CFU	Log Reduction	Percent Reduction
Lab control Time 0	46,000,000	7.66		
Lab control Time 8 hr	36,300,000	7.56	0.10	21.0
FN2 – no UV control 8 hr	190,000	5.28	2.28	99.5
FN2 – UV 8 hr	124,000	5.09	2.47	99.7
FN3 – no UV control 8 hr	102,000	5.01	2.55	99.7
FN3 – UV 8 hr	49,000	4.69	2.87	99.9

Conclusions:

The FN2 and FN3 coatings demonstrated antimicrobial properties against MRSA, *E. coli,* and *S. enterica* with greater effect under UV lighting conditions for 8 hours.

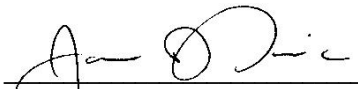
Signatures

Study Performed by:

Mona Ramadi, Ph.D.
Microbiologist

7/29/2020
Date

Report Issued by:



Jason Dobranic, Ph.D.
Vice President of Microbiology & Life Sciences
Study Director

7/29/2020
Date