LABOSPORT

# TEST REPORT

**GreensGroomer**

**Mr. Tom Moore**
P.O. Box 34151
Indianapolis, Indiana 46234 USA

**Date:** February 8th, 2011

**Report # : 10628 CANR / 11156 CANR**

**Samples # :** CAN000292, CAN000293, CAN000294, CAN000295.

**Subject:** Assessment of the effects of maintenance machinery on four synthetic turf fibers.

| **Product tested** |
|---|
| Maintenance was performed by placing the samples under direct germicidal UV-C energy (254nm) for 1, 6, and 24 hours:<br>• CAN000295/sample #8 (Nothing other than UV-C light touched the turf during the maintenance) - Control sample<br>• CAN000292/sample #5 (1 hour exposure (translates to 8 years of twice daily use))<br>• CAN000293/sample #6 (6 hours exposure (translates to 50 years of twice daily use))<br>• CAN000294/sample #7 (24 hours of exposure (translates to approx. 200 years of twice daily use))<br>Note 1: Maintenance has been carried out by GreensGroomer on new fibers.<br>Note 2: All the results in the pages below only refer to the tested samples received at the laboratory. |

| **Pick up samples conditions** |
|---|
| Received at the laboratory, **January 3rd, 2011.** |

| **Tests conditions** |
|---|
| **Sample conditioning:**<br>- Sample conditioned to **23°C / 50 % R.H.**<br>- Sample tested: **Month of January 2011.** |

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| Testing Program according to ASTM and EN Standards | |
|---|---|
| **Tests** | **Standards and Methods** |
| Observations | • Pictures taken with a classic zoom tool for showing fibrillation, bending and cracks.<br>• Pictures taken with scanning transmission electron microscope for showing fibrillation, bending and cracks.<br><br>**Comparison Method:**<br>Pictures have been compared each other using sample CAN000295/#8 as the control sample. Conclusion of the observation comparison is described in the tables below. |
| Laboratory Tests | • ASTM D1577-01 – *Linear density of textile fibers*<br>• ASTM D5823-05a – *Tuft height of pile floor covering*<br>• ASTM D792-08 Method A – *Density and specific gravity of plastics by displacement*<br>• Fiber Thickness / Pile Thickness<br>• DSC<br>• EN ISO 20105-A02 – *Color change*<br>• EN 13864 – *Tensile Strength*<br><br>**Comparison Method:**<br>For the testings for which we had enough individual results, we applied a statistical comparison method called Student's test. Student's test is used for assessing the statistical significance of the difference between two sample means. If the difference between the sample means is higher than 10%, the difference is considered significant, that is to say samples are different for the tested criteria. |

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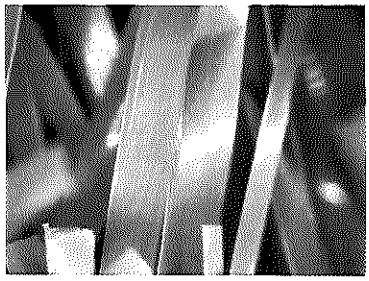
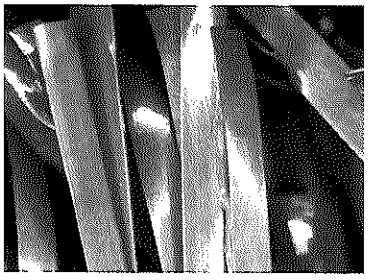
| Pictures taken with a classic zoom tool for showing fibrillation, bending and cracks. | |
|---|---|
| **CAN000295/sample #8**<br>(Nothing other than UV-C light touched the turf during the maintenance)<br>Control sample |  |
| **CAN000292/sample #5**<br>(1 hour exposure (translates to 8 years of twice daily use)) | |
| **CAN000293/sample #6**<br>(6 hours exposure (translates to 50 years of twice daily use)) |  |

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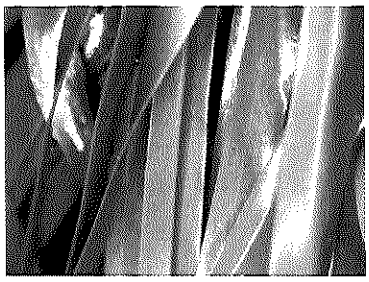
| | |
|---|---|
| **CAN000294/sample #7**<br>(24 hours of exposure (translates to approx. 200 years of twice daily use)) |  |

**Conclusion :**

No fibrillation, bending or cracks are visible on the samples using a classic zoom tool.

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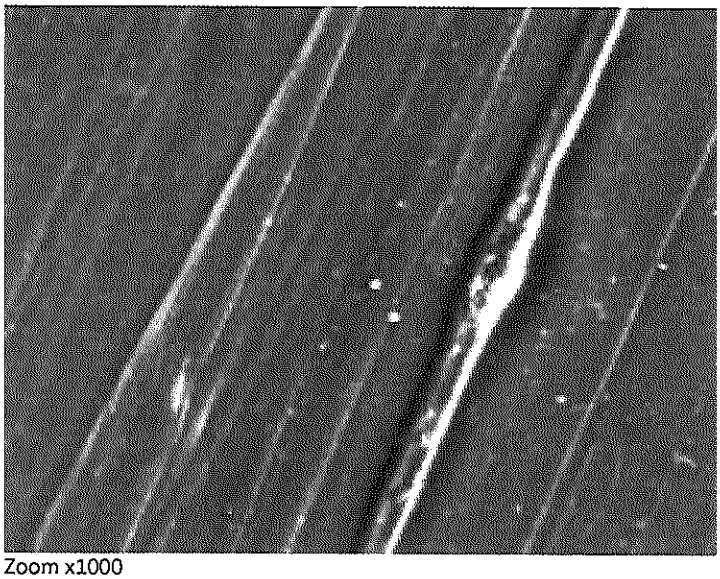
**Pictures taken with a scanning transmission electron microscope for showing fibrillation, bending and cracks.**

| | |
|---|---|
| **CAN000295/sample #8**<br>(Nothing other than UV-C light touched the turf during the maintenance)<br>Control sample | <br>Zoom x50<br>  <br>Zoom x1000 |

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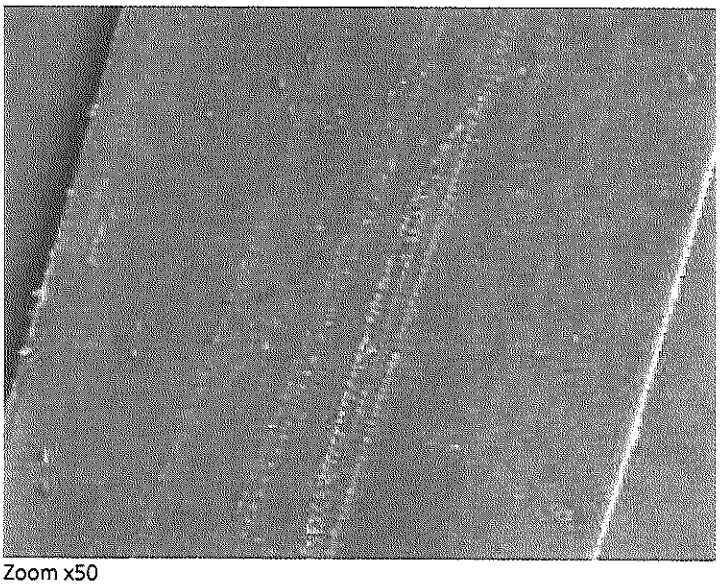
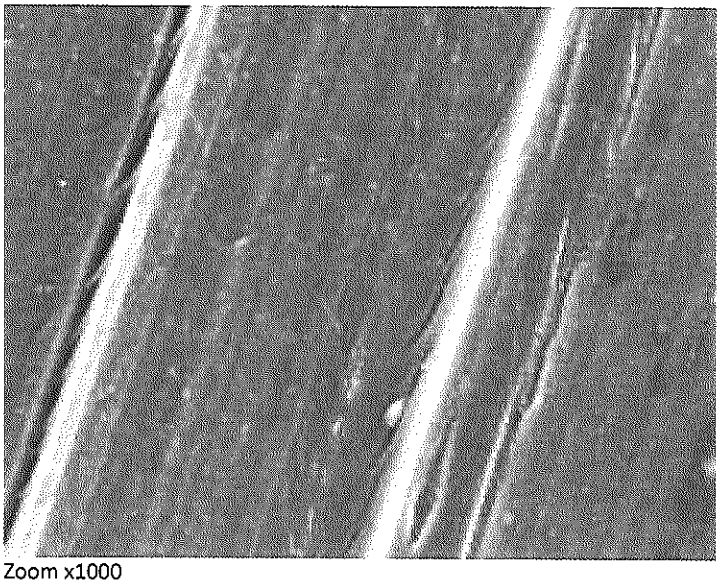
| | |
|---|---|
| **CAN000292/sample #5**<br>(1 hour exposure (translates to 8 years of twice daily use)) |  <br>Zoom x50<br>  <br>Zoom x1000 |

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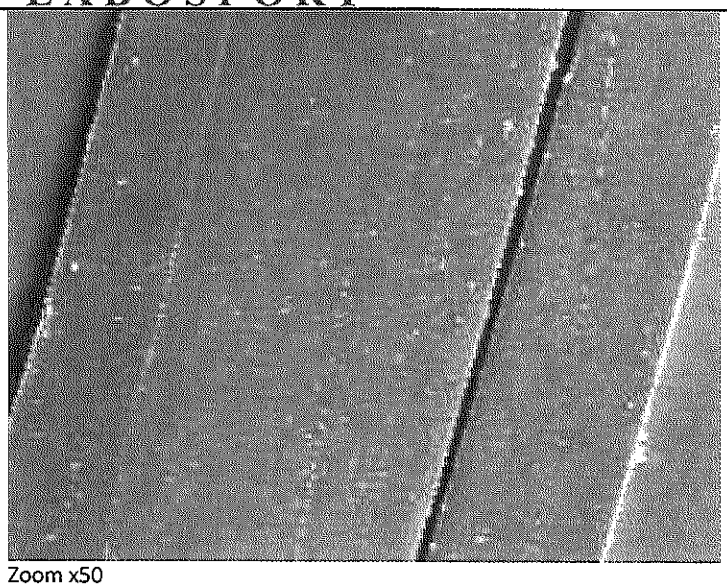
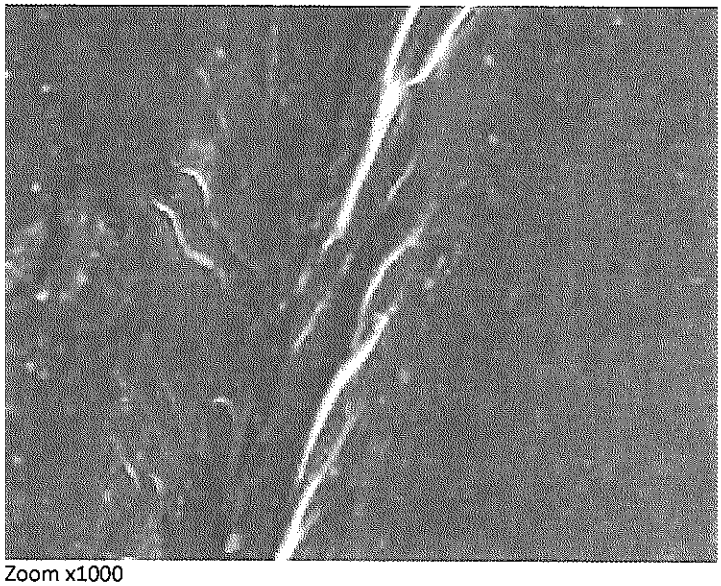
| | |
|---|---|
| **CAN000293/sample #6**<br>(6 hours exposure (translates to 50 years of twice daily use)) |  <br>Zoom x50<br>  <br>Zoom x1000 |

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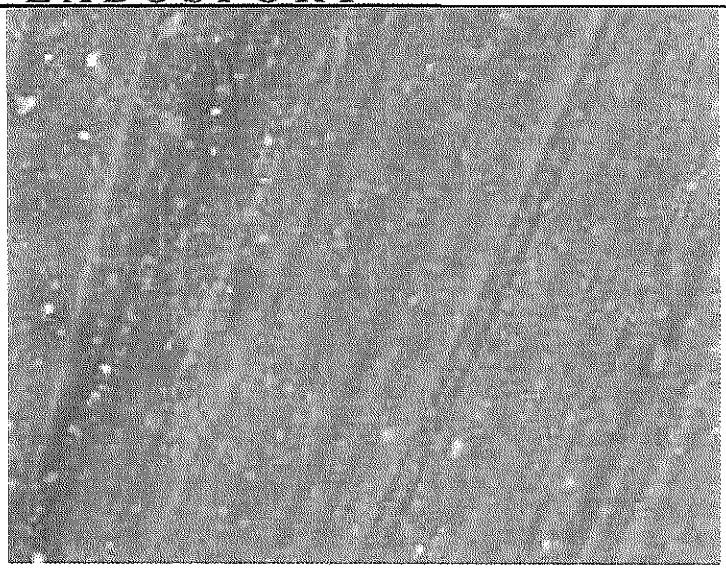
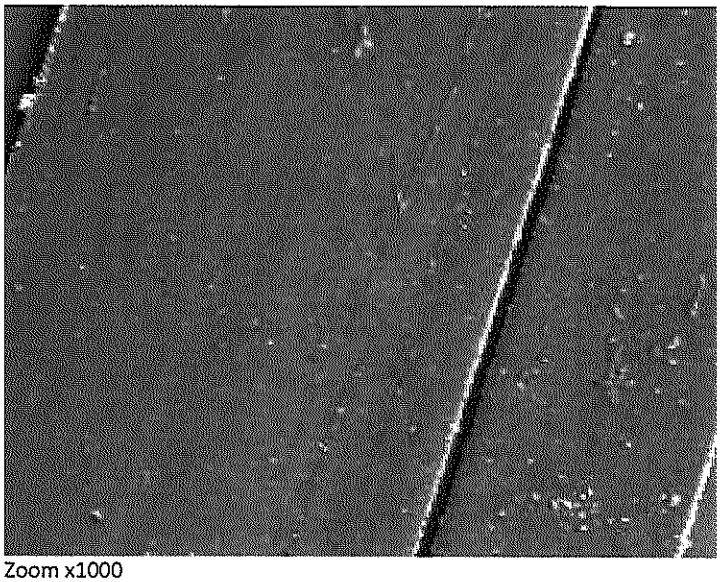
| | |
|---|---|
| **CAN000294/sample #7**<br>(24 hours of exposure (translates to approx. 200 years of twice daily use)) |  <br>Zoom x50<br>  <br>Zoom x1000 |

**Conclusion :**

No fibrillation, bending or cracks are visible on the samples using a scanning transmission electron microscope.

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**ASTM D1577-01– *Linear density of textile fibers***

| Product | | Individual Results | | | | | Average | Standard Deviation | Coefficient Variation |
|---|---|---|---|---|---|---|---|---|---|
| **CAN000295/sample #8** (Nothing other than UV-C light touched the turf during the maintenance) Control sample | **Pile Denier** | 8020,0 | 6490,4 | 7886,4 | 7789,1 | 8716,7 | 8012,0 | 650,0 | 8,11 |
| | | 8286,2 | 7736,8 | 8333,3 | 8029,7 | 8831,3 | | | |
| | **Pile Detex** | 8911,1 | 7211,5 | 8762,7 | 8654,5 | 9685,2 | 8902,2 | 722,3 | 8,11 |
| | | 9206,9 | 8596,5 | 9259,3 | 8921,9 | 9812,5 | | | |
| **CAN000292/sample #5** (1 hour exposure (translates to 8 years of twice daily use)) | **Pile Denier** | 7913,2 | 9050,9 | 8405,4 | 8214,5 | 8832,2 | 8563,3 | 374,1 | 4,37 |
| | | 8869,1 | 8779,2 | 8233,3 | 8901,8 | 8433,3 | | | |
| | **Pile Detex** | 8792,5 | 10056,6 | 9339,3 | 9127,3 | 9813,6 | 9514,8 | 415,7 | 4,37 |
| | | 9854,5 | 9754,7 | 9148,1 | 9890,9 | 9370,4 | | | |
| **CAN000293/sample #6** (6 hours exposure (translates to 50 years of twice daily use)) | **Pile Denier** | 8333,3 | 8747,4 | 8820,0 | 8447,4 | 8280,0 | 8286,9 | 587,2 | 7,09 |
| | | 8492,7 | 7998,1 | 6750,0 | 8501,8 | 8498,1 | | | |
| | **Pile Detex** | 9259,3 | 9719,3 | 9800,0 | 9386,0 | 9200,0 | 9207,6 | 652,4 | 7,09 |
| | | 9436,4 | 8886,8 | 7500,0 | 9446,4 | 9442,3 | | | |

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**ASTM D1577-01– *Linear density of textile fibers***

| Product | | Individual Results | | | | | Average | Standard Deviation | Coefficient Variation |
|---|---|---|---|---|---|---|---|---|---|
| CAN000294/sample #7 (24 hours of exposure (translates to approx. 200 years of twice daily use)) | Pile Denier | 8221,2 | 8065,4 | 8400,0 | 9139,7 | 8532,0 | 8337,4 | 336,6 | 4,04 |
| | | 8167,9 | 7997,7 | 8083,3 | 8514,0 | 8253,2 | | | |
| | Pile Detex | 9134,6 | 8961,5 | 9333,3 | 10155,2 | 9480,0 | 9263,8 | 374,0 | 4,04 |
| | | 9075,5 | 8886,4 | 8981,5 | 9460,0 | 9170,2 | | | |

| Statistical Analysis and Conclusion: Pile Denier - ASTM D1577-01– *Linear density of textile fibers* | Significant Difference % | Conformity (Significant Difference < 10%) | Student's test (Id = 18; α = 1%) | | Conformity (calculate value < table value) |
|---|---|---|---|---|---|
| **CAN000295/sample #8** (Nothing other than UV-C light touched the turf during the maintenance) Control sample | N/A | N/A | N/A | N/A | N/A |
| **CAN000292/sample #5** (1 hour exposure (translates to 8 years of twice daily use)) | 7 | no difference between the average | 2,32 | 2,878 | no difference between the average |
| **CAN000293/sample #6** (6 hours exposure (translates to 50 years of twice daily use)) | 3 | no difference between the average | 0,99 | 2,878 | no difference between the average |
| **CAN000294/sample #7** (24 hours of exposure (translates to approx. 200 years of twice daily use)) | 4 | no difference between the average | 1,41 | 2,878 | no difference between the average |
| **Conclusion:** According to the statistical Student's test result, there is no difference between the four tested samples. | | | | | |

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| ASTM D5823-05a – *Tuft height of pile floor covering* | |
|---|---|
| **Product** | **Individual Results mm** |
| **CAN000295/sample #8** (Nothing other than UV-C light touched the turf during the maintenance) Control sample | 54,65 |
| **CAN000292/sample #5** (1 hour exposure (translates to 8 years of twice daily use)) | 52,75 |
| **CAN000293/sample #6** (6 hours exposure (translates to 50 years of twice daily use)) | 52,25 |
| **CAN000294/sample #7** (24 hours of exposure (translates to approx. 200 years of twice daily use)) | 52,35 |
| **Note:** No statistical analysis could have been applied here. | |

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**ASTM D792-08 Method A – *Density and specific gravity of plastics by displacement***

| Product | Individual Results g/cm³ | | Average g/cm³ | Standard deviation | Coefficient variation% |
|---|---|---|---|---|---|
| **CAN000295/sample #8** (Nothing other than UV-C light touched the turf during the maintenance) Control sample | 0.955 | 0.954 | 0.955 | 0.001 | 0.1 |
| **CAN000292/sample #5** (1 hour exposure (translates to 8 years of twice daily use)) | 0.953 | 0.952 | 0.953 | 0.001 | 0.1 |
| **CAN000293/sample #6** (6 hours exposure (translates to 50 years of twice daily use)) | 0.948 | 0.951 | 0.950 | 0.002 | 0.2 |
| **CAN000294/sample #7** (24 hours of exposure (translates to approx. 200 years of twice daily use)) | 0.950 | 0.949 | 0.950 | 0.001 | 0.1 |

| **Statistical Analysis and Conclusion: ASTM D792-08 Method A – *Density and specific gravity of plastics by displacement*** | **Significant Difference %** | **Conformity (Significant Difference < 10%)** | **Student test (Id = 18; α = 1%)** | | **Conformity (calculate value < table value)** |
|---|---|---|---|---|---|
| **CAN000295/sample #8** (Nothing other than UV-C light touched the turf during the maintenance) Control sample | N/A | N/A | N/A | N/A | N/A |
| **CAN000292/sample #5** (1 hour exposure (translates to 8 years of twice daily use)) | 0 | no difference between the average | 2,83 | 4,3 | no difference between the average |
| **CAN000293/sample #6** (6 hours exposure (translates to 50 years of twice daily use)) | 1 | no difference between the average | 3,16 | 4,3 | no difference between the average |
| **CAN000294/sample #7** (24 hours of exposure (translates to approx. 200 years of twice daily use)) | 1 | no difference between the average | 7,07 | 4,3 | no difference between the average |

**Conclusion:** According to the statistical student's test result, there is no difference between the four tested samples.

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| Fiber Thickness | |
|---|---|
| **Product** | **Individual Results mm** |
| **CAN000295/sample #8** (Nothing other than UV-C light touched the turf during the maintenance) Control sample | 6,17 |
| **CAN000292/sample #5** (1 hour exposure (translates to 8 years of twice daily use)) | 4,78 |
| **CAN000293/sample #6** (6 hours exposure (translates to 50 years of twice daily use)) | 5,71 |
| **CAN000294/sample #7** (24 hours of exposure (translates to approx. 200 years of twice daily use)) | 4,35 |
| **Note:** No statistical analysis could have been applied here. | |

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| Pile Thickness | |
|---|---|
| **Product** | **Individual Results mm** |
| **CAN000295/sample #8** (Nothing other than UV-C light touched the turf during the maintenance) Control sample | 0,995 |
| **CAN000292/sample #5** (1 hour exposure (translates to 8 years of twice daily use)) | 0,1019 |
| **CAN000293/sample #6** (6 hours exposure (translates to 50 years of twice daily use)) | 0,1016 |
| **CAN000294/sample #7** (24 hours of exposure (translates to approx. 200 years of twice daily use)) | 0,1017 |

| **Statistical Analysis and Conclusion: Pile Thickness** | **Significant Difference %** | **Conformity (Significant Difference < 10%)** | **Student test (Id = 18; α = 1%)** | | **Conformity (calculate value < table value)** |
|---|---|---|---|---|---|
| **CAN000295/sample #8** (Nothing other than UV-C light touched the turf during the maintenance) Control sample | N/A | N/A | N/A | N/A | N/A |
| **CAN000292/sample #5** (1 hour exposure (translates to 8 years of twice daily use)) | 1 | no difference between the average | 0,45 | 2,878 | no difference between the average |
| **CAN000293/sample #6** (6 hours exposure (translates to 50 years of twice daily use)) | 3 | no difference between the average | 1,73 | 2,878 | no difference between the average |
| **CAN000294/sample #7** (24 hours of exposure (translates to approx. 200 years of twice daily use)) | 1 | no difference between the average | 1,00 | 2,878 | no difference between the average |

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**Conclusion:** According to the statistical student's test result, there is no difference between the four tested samples.

**EN ISO 20105-A02-*Color Change***

**Conclusion:** There is no difference between the four tested samples.

**EN 13864 – *Tensile Strength***

| Product | Maximum Strength (Average) N | Maximum Elongation (Average) mm |
|---|---|---|
| **CAN000295/sample #8** (Nothing other than UV-C light touched the turf during the maintenance) Control sample | 23,66 | 2,21 |
| **CAN000292/sample #5** (1 hour exposure (translates to 8 years of twice daily use)) | 35,13 | 3,09 |
| **CAN000293/sample #6** (6 hours exposure (translates to 50 years of twice daily use)) | 26,73 | 2,16 |
| **CAN000294/sample #7** (24 hours of exposure (translates to approx. 200 years of twice daily use)) | 30,90 | 2,10 |

**Note:** No statistical analysis could have been applied here.

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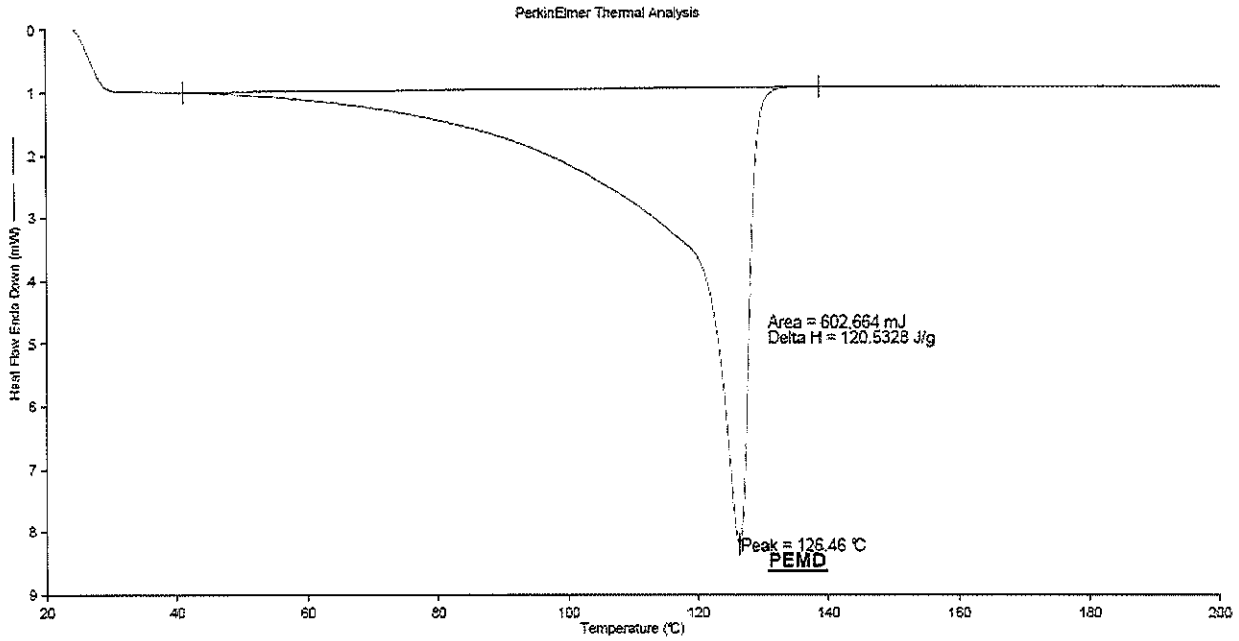
**CAN000295/sample #8**
(Nothing other than UV-C light touched the turf during the maintenance)
Control Sample

| | |
|---|---|
| Filename: | C:\Program Files\Pyris\Data\...\008515.pdid |
| Operator ID: | LC |
| Sample ID: | 008515 |
| Sample Weight: | 5.000 mg |
| Comment: | 110035 |
| | CAN 000295 |




1) Heat from 25.00°C to 300.00°C at 50.00°C/min
2) Cool from 300.00°C to 25.00°C at 40.00°C/min
3) Hold for 8.0 min at 25.00°C
4) Heat from 25.00°C to 350.00°C at 10.00°C/min

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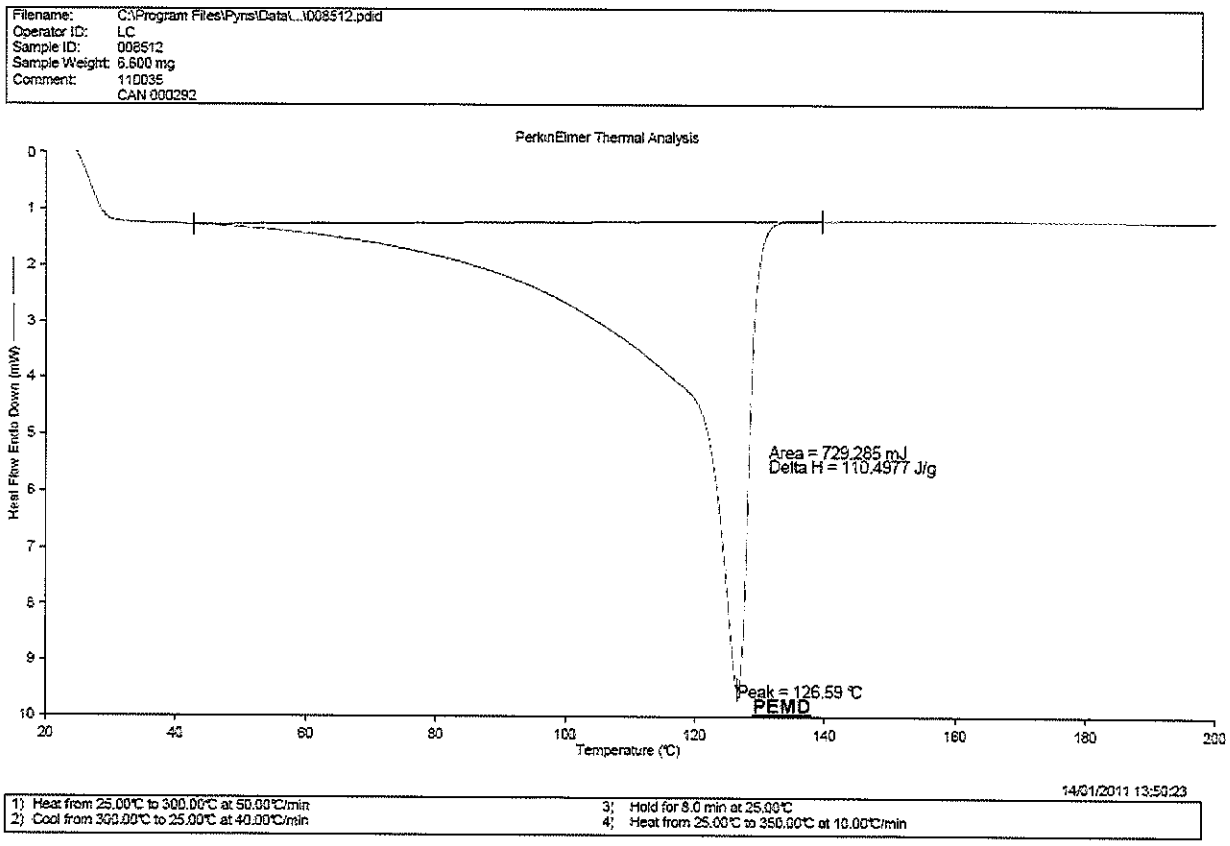
**CAN000292/sample #5**
(1 hour exposure (translates to 8 years of twice daily use))

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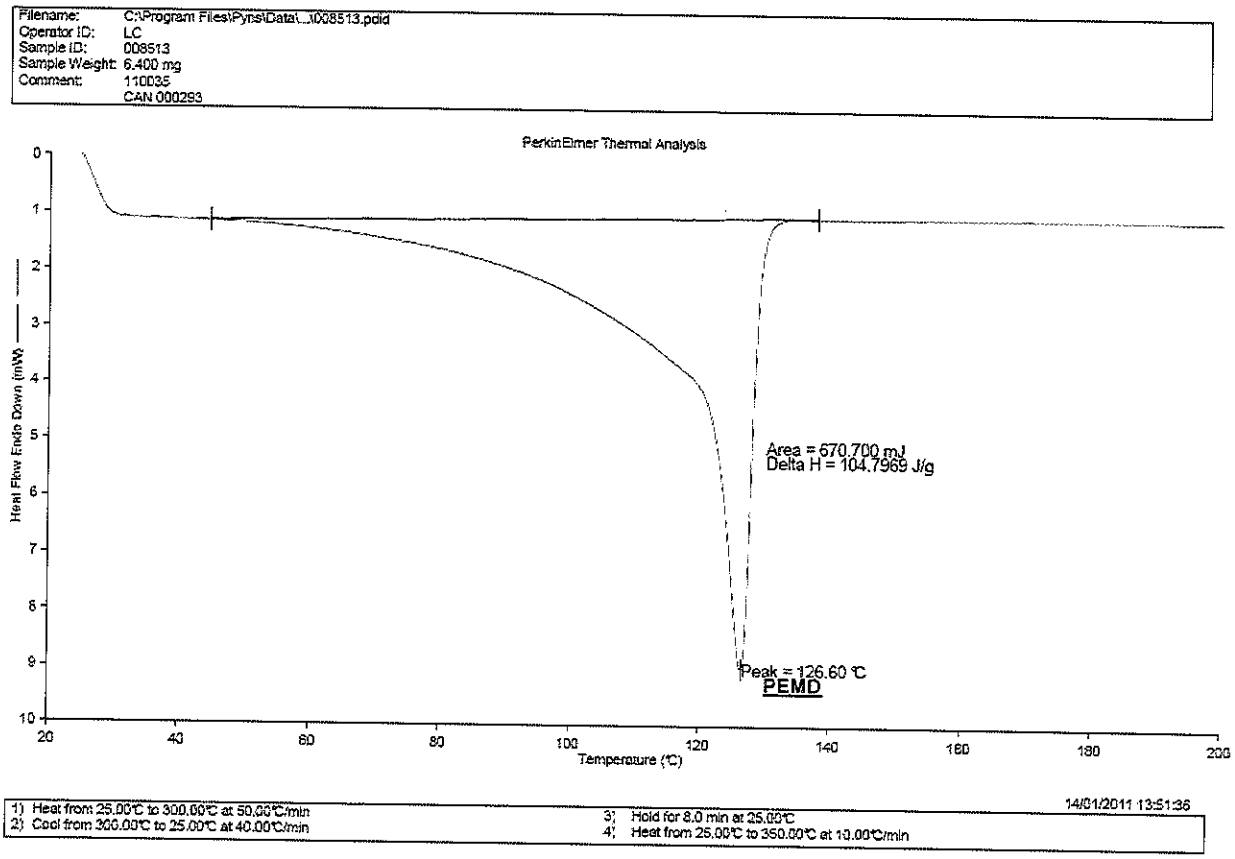
**CAN000293/sample #6**
(6 hours exposure (translates to 50 years of twice daily use))

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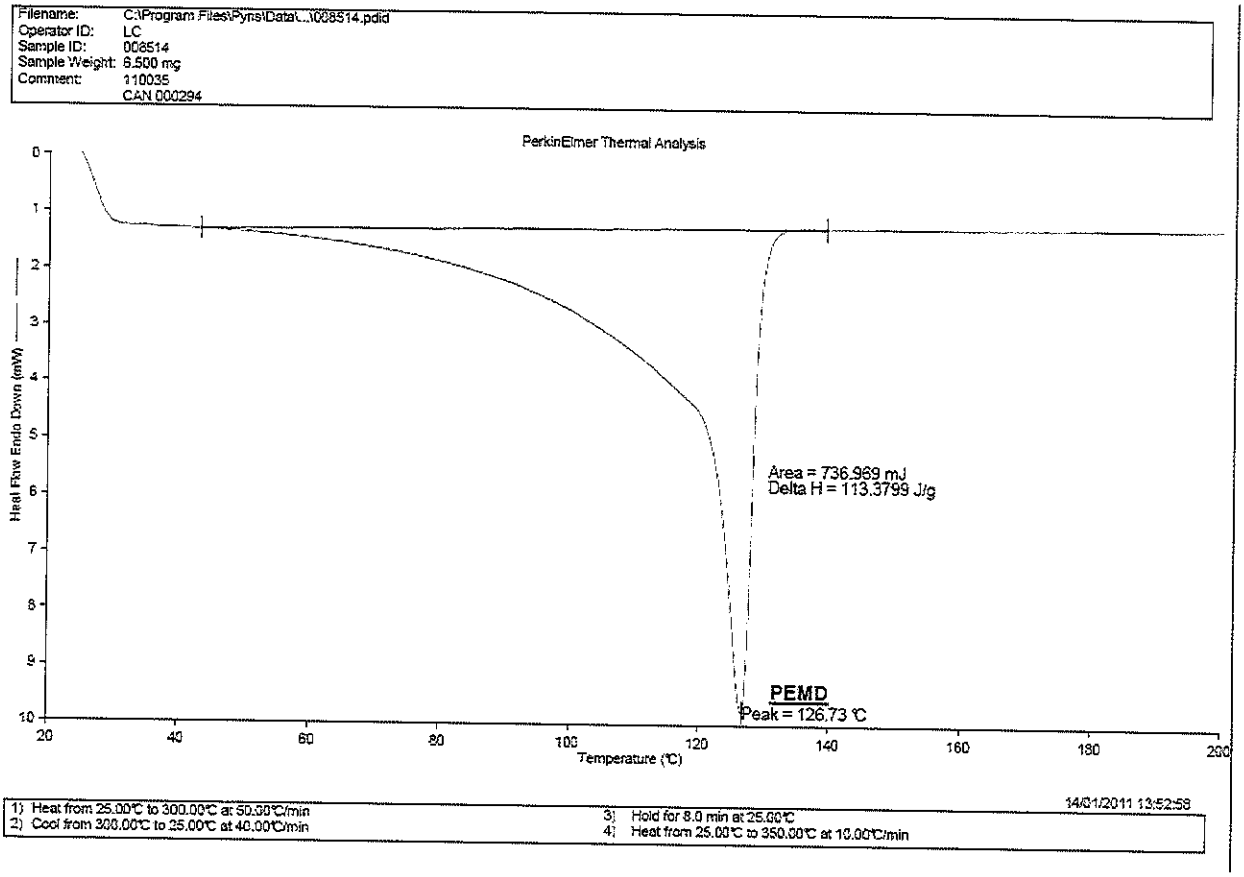
**CAN000294/sample #7**
(24 hours of exposure (translates to approx. 200 years of twice daily use))




**Conclusion:** No significant difference between samples.

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**General conclusion:**

According to the observations and statistical analysis and treatments on the testing results, no significant difference is detected between the four samples. Therefore, we can conclude that the maintenance treatment that Greensgroomer applied to the turf samples has no major damaging effect on the structure and integrity of the turf fibers.

Note that this does not prevent damage that could occur to a turf installation in the case where the maintenance machinery is not operated as per the manufacturer's guidelines and instructions.

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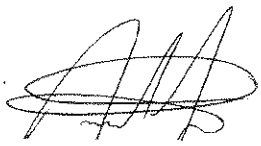
Guillaume Loubersac
Managing Director
Labosport Inc.



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