Antiviral Tests

Virus testing is unique because the presence of viruses before and after product treatment is not determined by observing growth of the virus but rather by observing the damage caused by infection to mammalian host cells. The damage caused to the healthy cell layers, referred to as cytopathic effects (CPE), is observed by specialized microscopy methods. In testing the efficacy of antiviral surfaces, the quantity of CPE caused by the virus to host cells, in comparison to a control, is used to assess virucidal or antiviral activity.

In addition to the viruses listed here, TCNA is able to acquire additional viruses to meet your testing needs. Contact Katelyn Simpson, Director of Laboratory Services, ksimpson@TCNAtile.com or 864-646-8453, to discuss viral acquisition and your testing options.

### Viruses available for testing

<table>
<thead>
<tr>
<th>Virus Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>SARS-CoV-2 surrogates</td>
</tr>
<tr>
<td>Adenoviruses</td>
</tr>
<tr>
<td>Hepatitis B</td>
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<tr>
<td>Hepatitis C</td>
</tr>
<tr>
<td>Norovirus</td>
</tr>
<tr>
<td>Influenza H1N1 Human</td>
</tr>
<tr>
<td>MSQ bacteriophage - viral screening tool</td>
</tr>
</tbody>
</table>

### ISO 21702:2019 Measurement of antiviral activity on plastics and other non-porous surfaces

**Purpose:** Measure antiviral activity on plastics and other non-porous surfaces of antiviral-treated products against specified viruses listed in the test.

Due to differences in viruses, the results of one test virus might not be applicable for other viruses and TCNA can include other viruses as desired and allowed by the standard. The viruses specified in the test method include *Feline calicivirus* (EPA surrogate for Norovirus) and *Influenza A virus* (H3N2).

After 24 hours of contact time with the surface of the sample, viruses are extracted from the test and control materials and enumerated virus by plaque assay. The extent of the antiviral effect after contact is calculated by comparing the test and the control materials according to criteria outlined in the standard.


**Purpose:** Determine the antiviral activity of materials that contain photocatalytic materials or have photocatalytic films on the surface by enumerating the destruction of bacteriophage Q-beta after irradiation of ultraviolet light.

The test method in this international standard provides a quantitative evaluation of the antiviral activity of photocatalytic materials by exposing the test material to an appropriate virus for two to eight hours under ultraviolet light at a predefined intensity.

### Additional Antiviral Testing Services

TCNA is also equipped to conduct:

- Initial and confirmatory virucidal effectiveness tests for US EPA. EPA-recommended antiviral testing with specific viruses for pesticide registration. These tests include ASTM and customized tests.
- Tests using EPA-approved surrogates.

**Test Preparation and Timeline:** Most antiviral studies require four to six weeks to grow and maintain the sterile cell cultures that are needed to propagate and detect viruses in antimicrobial efficacy studies. Some delay may occur due to non-availability of test organisms from suppliers or the revival of cell cultures and/or viruses from TCNA or supplier stocks.
## Antibacterial Tests

**ISO 22196:2011 Measurement of antibacterial activity on plastics and other non-porous surfaces**

<table>
<thead>
<tr>
<th>Purpose:</th>
<th>Evaluate the antibacterial activity of antibacterial-treated plastics and other non-porous surfaces of products (including intermediate products).</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>This test method provides evaluation of the antimicrobial efficacy of a product using the microorganisms <em>Staphylococcus aureus</em> (ATCC 6538) and <em>Escherichia coli</em> (ATCC 25922).</td>
</tr>
</tbody>
</table>

**ASTM E3031:2015 Standard test method for determination of antibacterial activity on ceramic surfaces**

<table>
<thead>
<tr>
<th>Purpose:</th>
<th>Quantitatively evaluate the antibacterial activity of glazed ceramic surfaces that have been specifically designed to contain an antibacterial treatment as part of the glaze.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>This test method compares the antibacterial efficacy of one ceramic surface to another ceramic surface under the stated conditions using the microorganism <em>Escherichia coli</em> (ATCC 8739).</td>
</tr>
</tbody>
</table>

## Antifungal Tests

**ASTM E1428:2015a Standard test method for evaluating the performance of antimicrobials in or on polymeric solids against staining by Streptomyces species (a pink stain organism)**

<table>
<thead>
<tr>
<th>Purpose:</th>
<th>Assess the susceptibility of products to pink-staining by the actinomycete bacteria Streptomyces species.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Results will also be supplied as L<em>a</em>b* measurements for quantification of the discoloration compared to a non-treated sample.</td>
</tr>
</tbody>
</table>

**ASTM G21:2015 Standard practice for determining resistance of synthetic polymeric materials to fungi**

<table>
<thead>
<tr>
<th>Purpose:</th>
<th>Determine the resistance of a material to the growth of fungi.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>This method tests the growth of five fungi commonly identified on building and construction materials: <em>Aspergillus brasiliensis</em>, <em>Penicillium funiculosum</em>, <em>Chaetomium globosum</em>, <em>Trichoderma virens</em>, and <em>Aureobasidium pullulans</em>.</td>
</tr>
</tbody>
</table>

## Antialgal Tests

**ASTM G29:2016 Standard practice for determining algal resistance of polymeric films**

<table>
<thead>
<tr>
<th>Purpose:</th>
<th>Determine the susceptibility of materials to the attachment and proliferation of surface-growing algae.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>This test method provides evaluation of the antialgal efficacy of a product using the microorganism <em>Oscillatoria</em>.</td>
</tr>
</tbody>
</table>
**Additional Tests for Products with Photocatalytic Coatings**

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ISO 27447:2019</strong> (Fine ceramics, advanced technical ceramics) — Test method for antibacterial activity of semiconducting photocatalytic materials</td>
<td></td>
</tr>
<tr>
<td><strong>Purpose:</strong> Determine the antibacterial activity of materials that contain a photocatalyst or have a photocatalytic film on the surface by enumeration of bacteria after irradiation with ultraviolet light.</td>
<td>This test method provides evaluation of the antimicrobial efficacy of a product using the microorganisms <em>Staphylococcus aureus</em> (ATCC 6538) and <em>Escherichia coli</em> (ATCC 25922).</td>
</tr>
<tr>
<td><strong>Purpose:</strong> Determine removal of pollutant gases and NOx's in the presence of a photocatalytic surface during exposure to UV light.</td>
<td>The test specimen is exposed to a steady inflow of NOx gases in predetermined concentrations. The NOx concentration is measured during exposure to UV light and also in the dark for comparison.</td>
</tr>
<tr>
<td><strong>ISO 22197-4:2013</strong> (Fine ceramics, advanced technical ceramics) — Test method for air-purification performance of semiconducting photocatalytic materials — Part 4: Removal of formaldehyde</td>
<td></td>
</tr>
<tr>
<td><strong>Purpose:</strong> Determine removal of the pollutant gas formaldehyde in the presence of a photocatalytic surface during exposure to UV light.</td>
<td>The test specimen is exposed to a steady inflow of formaldehyde in predetermined concentrations. The formaldehyde concentration is measured during exposure to UV light and also in the dark for comparison.</td>
</tr>
<tr>
<td><strong>ISO 22197-5:2013</strong> (Fine ceramics, advanced technical ceramics) — Test method for air-purification performance of semiconducting photocatalytic materials — Part 5: Removal of methyl mercaptan</td>
<td></td>
</tr>
<tr>
<td><strong>Purpose:</strong> Determine removal of the pollutant gases acetaldehyde (ISO 22197 – Part 2), toluene (ISO 22197 – Part 3), and methyl mercaptan (ISO 22197 – Part 5) in the presence of a photocatalytic surface during exposure to UV light.</td>
<td>These methods are combined herein as they use the same experimental set-up, which differs from that used for ISO 22197-1 (NOx) and that used for ISO 22197-4 (formaldehyde) listed above.</td>
</tr>
</tbody>
</table>
**ISO 13125:2013 Fine ceramics (advanced ceramics, advanced technical ceramics) — Test method for antifungal activity of semiconducting photocatalytic materials**

**Purpose:** Determine the antifungal activity of materials that contain an antimicrobial agent by counting the number of pre-incubated fungal spores that survive exposure to the antimicrobial agent.

This test method provides evaluation of the antifungal efficacy of a product using the microorganisms *Aspergillus niger* and *Penicillium pinophilum*.

**ISO 10678:2010 Fine ceramics (advanced ceramics, advanced technical ceramics) — Determination of photocatalytic activity of surfaces in an aqueous medium by degradation of methylene blue**

**Purpose:** Determine the photocatalytic activity of materials by degradation of the dye methylene blue (MB) in aqueous solution with exposure to ultraviolet (UV) radiation.

This characterizes the ability of photoactive surfaces to degrade dissolved organic molecules during exposure to ultraviolet radiation.

**UNI 11259:2008 Determination of photocatalytic activity of hydraulic binders – Rhodamine B**

**Purpose:** Determine the photocatalytic activity of materials by degradation of the organic dye Rhodamine B with exposure to ultraviolet (UV) radiation.

Reduction in the dye is measured through spectrophotometry of the test surface. This characterizes the ability of photoactive surfaces during exposure to ultraviolet radiation to degrade organic molecules directly contaminating a surface.

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**Cytotoxicity/Hypoallergenicity Testing**


**Purpose:** Evaluate the toxicity of materials and chemicals by exposing cultured cells to the test sample. Cytotoxicity is a biocompatibility test performed on mammalian cells in culture.

There are three *in vitro* cytotoxicity tests: MEM Elution, Agarose Overlay, and Direct Contact.