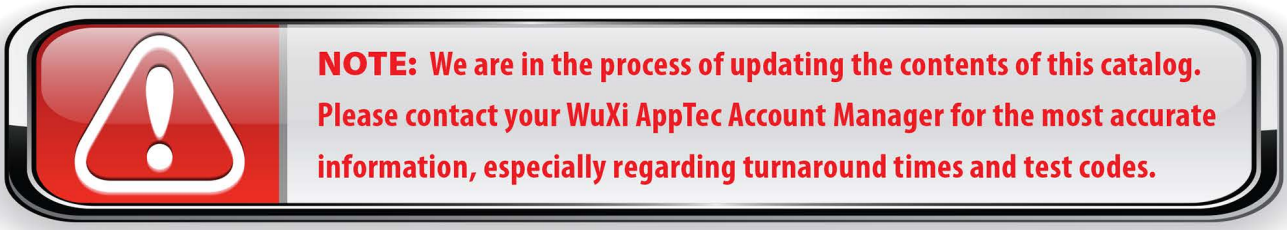

ANTIMICROBIAL TESTING

Antimicrobial studies are used to evaluate the efficacy of an antimicrobial agent. WuXi AppTec's comprehensive efficacy testing program provides relevant data that can speed formulation selection, verify product performance, and confirm the efficacy of antimicrobial agents when combined with devices.

The program features *in-vitro* tests, which can quickly evaluate activity and potency of antimicrobial agents; biofilm quantification studies, which evaluate candidate materials and dose levels to determine impact on biofilm formation; and *in-vivo* studies, which evaluate the antimicrobial effectiveness of final product candidates in a biologic system.

Also offered are antimicrobial assays used to determine or confirm the effectiveness of treatments applied to commercial textiles and other industrial products.

IN THIS SECTION

ANTIMICROBIAL EFFICACY TESTING – *IN VITRO* ASSAYS FOR DEVICES / COMBINATION PRODUCTS

WuXi AppTec offers the following assays to quantitatively or semi-quantitatively evaluate the antimicrobial activity of medical devices, components or other materials treated with antimicrobial agents. Many of the standard test methods listed here may be modified to include different or additional organisms as well as different or additional exposure times based on product application, claims and characteristics, activity of medical devices, components or other materials treated with antimicrobial agents. Any of the standard test methods listed here can be modified to include different/additional organisms as well as different/additional exposure times based on product application, claims and characteristics.

Contact our Atlanta laboratory for more information.

MINIMUM SAMPLE REQUIREMENTS: Contact lab.

190660 **USP <51>** **Antimicrobial Effectiveness**	Determines the effectiveness of antimicrobial (preservative) substances for the following products: injections and other parenterals including emulsions, otic products, sterile nasal products and ophthalmic products made with aqueous bases or vehicles; topically used products made with aqueous bases or vehicles, nonsterile nasal products, and emulsions, including those applied to mucous membranes; oral products other than antacids, made with aqueous bases or vehicles; antacids made with an aqueous base. Typically conducted prior to conducting microbial recovery assays involving products with potential inhibitory or microbicidal activity. Samples are inoculated with known levels of micro-organisms and are evaluated for degree of inhibition over a 28-day period.
190661 **USP <1227>** **Validation of Microbial Recovery (Neutralization Validation)**	Evaluates the method chosen to neutralize the antimicrobial properties of any product with inhibitory or microbiocidal activity. The purpose of the assay is to ensure the validity of test results achieved during the USP <51> Antimicrobial Effectiveness test and other microbial recovery tests. It is conducted prior to estimating the number of viable micro-organisms.
190665 **JIS Z 2801 / ISO 22196**	Specifies the testing methods to quantitatively evaluate antimicrobial activity and antimicrobial efficacy of bacteria on the surface of antimicrobial products. Recommended test organisms are *Staphylococcus aureus* and *Escherichia coli*. Triplicate samples are inoculated and evaluated for antimicrobial activity over selected contact periods between 1 to 24 hours.

ANTIMICROBIAL EFFICACY TESTING – *IN VITRO* ASSAYS FOR DEVICES / COMBINATION PRODUCTS

Demonstrates activity/potency of antimicrobials or antibiotics, based on measuring the zone of inhibition observed for specified microorganisms. Areas of particular application include materials treated or infused with an antimicrobial agent that leaches out of the material.	**110790** **Zone of Inhibition / Kirby-Bauer Susceptibility**
Quantitatively evaluates theeffectiveness of a sample treated with a non-leaching antimicrobial by shaking in an organism suspension. The typical challenge organism is *Klebsiella pneumoniae*. Samples are exposed to the challenge organism in a liquid suspension for one (1) hour under continuous agitation. The percent reduction of the challenge organism is then calculated.	**110780** **ASTM E-2149 – Dynamic Contact**
Quantitatively evaluates the effectiveness of an antimicrobial agent incorporated into hydrophobic polymeric material. Recommended challenge organisms are *Staphylococcus aureus* and *Pseudomonas aeruginosa* (or *Klebsiella pneumoniae*). An aqueous-based bacterial inoculum remains in close contact with the treated material as a "pseudo-biofilm." Treated and non-treated (control) samples are compared for determination of percent reduction over a defined time period.	**110770** **ASTM E-2180 – Bound Antibacterial Activity**
Duplicate samples are inoculated with the selected challenge microorganisms and changes in that inoculum population are evaluated at time points selected based on intended use of the material or over a longer period of time to develop a kill model for the material.	**110795** **ASTM E-2315 – Time-Kill Procedure**
This test method evaluates the ability of the test material to provide a barrier to microbial penetration. A portion of test material is placed on the surface of an agar plate.	**1625510** **Microbial Barrier / Strikethrough**
Determines the efficacy of sanitizing agents on various inanimate surfaces, such as counters, floors and other areas/materials that are routinely cleaned. These studies are used to evaluate the log reduction of challenge organisms when exposed to specific disinfection agents or antimicrobial processes. Typically conducted to validate sanitizing procedures for cleanrooms or aseptic processing areas.	**Custom** **ASTM E-1153 / USP <1072> – Sanitizer Efficacy**

ANTIMICROBIAL EFFICACY TESTING – *IN VIVO* STUDIES FOR DEVICES / COMBINATION PRODUCTS

Custom

Antimicrobial Efficacy (AME) – *In Vivo* Studies

FDA-accepted animal models (developed by WuXi AppTec) test the efficacy of antimicrobial components incorporated into medical devices, providing an infectious agent-challenge study to evaluate antimicrobial-device combinations. Each antimicrobial efficacy (AME) study is custom designed, using a number of clinically relevant bacterial strains, and several implant methodologies to produce a consistent and non-lethal *in vivo* device infection to assess and compare antimicrobial device components. Analyses of infection at device explant include quantitative assessment of remaining bacteria from device and surrounding tissue, imaging capabilities, and specific strain identification to confirm the bacterial strain of the resulting infection.

Bacterial Strains

WuXi AppTec's library of bacterial strains continues to expand. The bacterial strains most commonly used in developing *in vivo* device infections include:

- *Staphylococcus aureus*
- *Staphylococcus epidermis*
- *Staphylococcus capitis*
- *Escherichia coli*
- *Acinetobacter baumannii*
- Methicillin-resistant *Staph A* (MRSA)
- Clinical isolates provided by Sponsor

Additional Analyses

Additional available analyses include:

- *In vitro* antimicrobial tests, including Zone of Inhibition
- Histopathology to assess local response and microscopic evidence of bacterial infection
- Biochemical and DNA identification of recovered bacterial strains
- Hematology and clinical chemistry analyses to assess signs of infection and disease progression
- Drug analysis of serum and tissue samples
- Imaging analysis of explanted device surfaces, including scanning electron microscopy and confocal laser scanning microscopy

Samples for Antimicrobial Efficacy *In Vivo* Studies should be shipped to our St. Paul facility.

Contact your WuXi AppTec Account Manager for further information regarding these studies.

BIOFILM STUDIES

This method is designed to generate a biofilm under “high fluid shear” conditions where the shear is caused by the continuous movement of the test sample surface over a low nutrient medium in a continuously stirred flow reactor.	**110783** **ASTM E-2196 Rotating Disk Reactor**
This method is designed to generate a biofilm under “low fluid shear” conditions close to the air/ liquid interface under nutritive conditions caused by the flow of nutrients, by gravity, over the surface of the sample.	**110796** **ASTM E-2647 Drip Flow Biofilm Reactor**
This method is designed to generate a biofilm under “high wall shear” conditions where the shear is caused by the continuous flow of nutrients over the surface of the sample where the flow of nutrients is controlled in a continuously stirred flow reactor.	**110797** **ASTM E-2562 CDC Reactor**

Contact your WuXi AppTec Account Manager for further information regarding these studies.

INDUSTRIAL PRODUCT ANTIMICROBIAL ASSAYS

Antimicrobial assays are used to determine or confirm the effectiveness of treatments applied to commercial textiles and other industrial products. Test methods for measuring antimicrobial activity include ASTM, AATCC, USP and other standard or modified methods. Testing includes antibacterial and antifungal activity, with both qualitative and quantitative assays available.

Note: Test parameters in the following descriptions are those found in the standard method referenced. Many test methods allow modifications to these parameters based on product application, claims and characteristics. Contact the lab for more information or to discuss specific modifications.

SAMPLE REQUIREMENTS: Contact the Atlanta facility.

110700 **AATCC Method 30, Part III**	Samples are inoculated with *Aspergillus brasiliensis* and evaluated for the degree of growth over a 7-day period.
110710 **AATCC Method 100**	Samples are inoculated with *Staphylococcus aureus* and *Klebsiella pneumoniae* and evaluated for percent reduction of the bacteria over selected contact periods between 1 to 24 hours.
110720 **AATCC Method 147**	Samples placed in direct contact with *Staphylococcus aureus* and *Klebsiella pneumoniae* inoculum streaks are evaluated for inhibition of growth and zones of inhibition within 24 hours.
110730 **AATCC Method 174, Part 1**	The same principle as AATCC Method 147 *(above)*, but specific for carpets.
110740 **AATCC Method 174, Part 2**	The same principle as AATCC Method 100 *(above)*, but specific for carpets.
110750 **AATCC Method 174, Part 3**	The same principle as AATCC Method 30, Part III *(above)*, but specific for carpets.

Quantitatively evaluates the effectiveness of a sample treated with a non-leaching antimicrobial by shaking in an organism suspension. The typical challenge organism is *Klebsiella pneumoniae*. Samples are exposed to the challenge organism in a liquid suspension for one (1) hour under continuous agitation. The percent reduction of the challenge organism is then calculated.	**110780** **ASTM E-2149 – Dynamic Contact**
Quantitatively evaluates the effectiveness of an antimicrobial agent incorporated into hydrophobic polymeric material. Recommended challenge organisms are *Staphylococcus aureus* and *Pseudomonas aeruginosa* or *Klebsiella pneumoniae*.	**110770** **ASTM E-2180 – Bound Antibacterial Activity**
Quantitatively evaluates the antimicrobial activity of a test material within a specified time period using a time-kill procedure. The procedure utilizes test organisms that may be representative of the microbial flora encountered under conditions of use, or may represent standardized strains.	**110795** **ASTM E-2315 – Time-Kill Procedure**
Qualitatively evaluates (both stereo-microscopically and visually) antibacterial and antifungal activity at the fiber layer and at the primary backing layer of carpet when challenged with *Aspergillus niger*, *Serratia marcescens* and *Staphylococcus aureus*.	**110785** **ASTM E-2471 – Antimicrobial Activity in Carpet**
Semi-quantitatively evaluates ability of synthetic polymeric test material to support the growth of a mixture of five (5) fungi. Synthetic polymeric test material is usually provided in the form of molded and fabricated articles, tubes, rods, sheets and film materials. Samples are inoculated with the fungi mixture and evaluated for the degree of growth for up to 28 days.	**110760** **ASTM G-21 Antifungal, Semi-Quantitative**
This is a modified susceptibility test where the sample is in direct contact with an inoculum of a specified organism. The sample is evaluated for zone of inhibition.	**110790** **Zone of Inhibition / Kirby-Bauer**