

Strategic Partner

INNOVATIVE MICROBIAL FUEL TESTING



CORPORATE BACKGROUND AND HISTORY

CONIDIA BIOSCIENCE LTD, BASED IN SURREY, HAS BEEN TRADING SINCE 2002

The organisation was spun out from the not for profit, international, intergovernmental research and publishing organisation, CABI, to exploit the commercial potential of its research director's invention.

Conidia's patented intellectual property, **FUELSTAT®** based on immunoassay technology, was first presented in the form of a rapid test kit for the aviation industry. Its adoption was swift, given the highly regulated and conservative nature of the industry.

The product's credibility is enhanced by International Air Transport Association (IATA) recommendation and inclusion in the Boeing, Airbus, Embraer, BAE Systems, Fokker, Bombardier and Raytheon maintenance manuals. The kit is currently regularly purchased by 350+ airlines and aircraft maintenance organisations around the world.

As a major shareholder, CABI shares its extensive facilities with Conidia, including its UKAS ISO 17025 accredited laboratory facility. Dr Joan Kelley, **FUELSTAT®** inventor and Technical Director of both CABI and Conidia, manages and orchestrates the extensive Conidia R&D programme.

Other Conidia shareholders include two corporate investors and an Austrian life science strategic partner, Biomedica Group, which is actively involved in Conidia's R&D and production.



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SCIENTIFIC BACKGROUND

There is a small number of microbes which can degrade fuel, they tend to work together as a consortium.

The most dominant micro-organism in aviation fuel is Hormoconis resinae (H.res), previously known as Cladosporium resinae, which is commonly referred to as the "Jet Fuel Fungus" or, in diesel, the "Diesel Bug". Conditions in which microbial contamination may be present in fuel vary, but include temperature, humidity and the quality and composition of fuel and its water content (water can migrate into fuel from a variety of sources including condensation, humidity and poor handling). Diesel with bio-fuel content is particularly susceptible due to its hygroscopic nature.

Monitoring fuel systems for microbial contamination on a regular basis is important. H.res does not merely float around in the fuel and water phases or at the water/fuel interface like other contaminants, it adheres to the internal surfaces of the tank and fuel system. The damaging effects of H.res contamination can include corrosion of fuel tanks and fuel lines, as well as filter blockage and fuel system component damage. If infestations go undetected and untreated the consequences in aircraft and other machinery can be dramatic, in both financial and safety terms.

The original Conidia test was designed to detect both the presence and the level of H.res in aviation fuel. H.res is an excellent predicator of kerosene contamination levels. The new Conidia tests. FUELSTAT® RESINAE PLUS and FUELSTAT® DIESEL PLUS have been designed to provide rapid results accurately indicating the levels of all fuel grown organisms involved in contamination. This allows the test to be used for detecting contamination in all classes of middle distillate aviation and diesel fuel.



TEST KIT HISTORY

FUELSTAT[®] Resinae

1ST AVIATION FUEL TEST - FUELSTAT® RESINAE

The first test to emerge from Conidia's R&D programme was **FUELSTAT® RESINAE**, designed to measure the total contamination based on levels of H.res in aviation fuel.

The 2 lateral flow devices test for the presence of a compound given off by the organism only when it is growing in fuel. There are two devices, one is set at the boundary between negligible and moderate contamination and the other between moderate and heavy contamination. The significant benefits offered by **FUELSTAT® RESINAE** versus other competitive tests include its accuracy, rapid results (typically within 10 minutes), and the lack of a need for special training, skill-set or laboratory equipment.



2ND AVIATION FUEL TEST -Fuelstat® resinae plus

In response to requests from civil and defence operators

for a test indicating the presence of a broader range of organisms, Conidia's research scientists have answered the need with a next generation fuel test. Using the same technology as the original tests, the new kits now report on H.res, other moulds, yeasts and aerobic bacteria. The new test retains the advantages of the original product including speed, accuracy, ease of use and simplicity. Also, like the first test, its components do not require any special disposal procedures.

FUELSTAT® DIESEL PLUS

DIESEL TEST – FUELSTAT® DIESEL PLUS

This test for diesel fuels is based on the same innovative technology as the second generation aviation test. This test similarly measures levels of the groups of microbial

contaminants. The test's sensitivity has been adjusted to match market requirements. The test represents a major improvement on the dip slide and thixotropic gel tests in terms of usability, speed and accuracy. Immunoassay technologies are the next generation solution, delivering increased accuracy in microbial contamination detection. Experience in the aviation industry has shown that the overall cost of ownership of this new system is less than that of traditional Colony Forming Unit (CFU) systems.

> Rapid screening of fuel samples (water in fuel or fuel only), provides on-site, rapid and accurate assessment of H.res, other moulds, yeasts and aerobic bacteria levels in the fuel system. The test measures the amount of active growth in the sample, and provides action and alert levels in 10 minutes.

In aviation, IATA recommends a test frequency of at least once every 12 months. In the diesel industry Conidia also recommends testing fuel tanks at least once a year. As in aviation, the test frequency should be increased in high temperature and/or humidity conditions, or where fuel quality is in doubt. A risk assessment by a qualified professional is always advised.

THE LATERAL FLOW DEVICE (LFD)



FUELSTAT® TEST IN DETAIL

INTRODUCTION

The Conidia test is an immunoassay device (rather like a pregnancy test) which measures the amount of different types of contamination growing in a sample harvested from either the fuel or water phases and reports the results as the weight of active material in that sample. This is a newer, faster and more accurate measurement system than the older Colony Forming Unit (CFU) count methodologies.

OBJECTIVE

The objective of the Conidia test is to provide rapid screening of samples, ignoring any micro-organisms that have entered from elsewhere (through tank breather vents for example), which may have been growing on trees or other food sources. Other tests will indiscriminately grow whatever they find in the sample, whether it came from the fuel or not. Other tests also require sterile sampling conditions, where Conidia's test just requires that the sample equipment is clean (i.e. has no residue from a previous test sample). Conidia tests take 10 minutes to operate. Most other tests take a minimum of 2 to 3 days to give a full picture of bacterial and fungal contamination.

As some fungal spores take a number of days to show significant growth, traditional growth based testing techniques may take several days to produce a comprehensive result. During that time, samples may have to be incubated and many have to be monitored daily. ATP (Adenosine tri-phosphate) based tests while rapid, show total life and may not, therefore, discriminate actively growing organisms.

RESULTS

The results from many competitor products are deduced either by comparing colours or spot numbers with a chart or (if high accuracy levels are required) counting under a microscope. Conidia's test just requires visual inspection of the six lateral flow devices on the test paddle.

The readings will indicate the level of contamination in the sample: negligible, moderate or heavy. These levels correspond to the recommended limits set out in the IATA guidelines for negligible, moderate and heavy contamination.

DISPOSAL

Unlike competitor kits which require special handling for testing and/or safe disposal, Conidia kits (apart from the fuel itself, of course) can be disposed of in any domestic waste disposal or recycled, if there is a plastics recycling policy in place.



TECHNICIAN Set up to Conduct the test



THE TEST BEING CARRIED OUT



FUELSTAT® TEST RESULTS

Full instructions are included in each test kit and they include actions and advice following a positive low or high contamination result. Animated on line instructions can be found by use of this QR code.



LEVEL 1 (LOW LEVEL)

3 devices on the right side of the test paddle have cut off levels for H.res, bacteria and fungi, at a level derived from the IATA Guidance Material, where the microbes have established themselves as a consortium and a fuel treatment is required.

LEVEL 2 (HIGH LEVEL)

3 devices on the left side of the test paddle have cut off levels for H.res, bacteria and fungi, at a level derived from IATA Guidance Material, where the microbes are growing so rapidly, or have been growing for such a long time, that they may be causing damage to the structure of the tank, or are likely to cause filter blockage and component failure. In this case, a tank clean and fuel treatment will be required.

DIESEL APPLICATIONS

Conidia's new test delivers the same benefits to all diesel users. Users from various industries including stand-by generation, filling stations, fuel storage and supply, road haulage, mining, plant and equipment users & hire companies are using or evaluating the test.

FURTHER DEVELOPMENTS

Conidia's research team is working on SRB (Sulphate Reducing Bacteria) detection along with other innovative test methods applicable to both fuel and wider industrial uses.



FAQ'S MONITORING & TREATING AVIATION & DIESEL FUEL STORAGE TANKS

WE ROUTINELY BIOCIDE OUR FUEL TANKS, WHAT Added Value Would Fuelstat® OFFER US?

- This question supposes that the fuel system operating procedure currently in place includes draining water and then administering biocide to the fuel in the storage tank. Draining the water from the tanks is the key basis for any control system. There are, however, problems associated with routine prophylactic application of biocides.
- 1. There are significant costs in manpower terms and of the biocide itself.
- 2. There can be problems with warranties from the engine manufacturers if there is any doubt about the ppm (parts per million) levels of biocide added to the fuel.
- 3. Routine use of biocides has risks in two other areas:
 - There are health and safety considerations in the use and handling
 of biocides; their use should, therefore, be restricted to the minimum
 required to maintain clean fuel. The environmental impact of indiscriminate
 applications of biocide on exhaust gas emissions should be considered.
 - Unless the correct ppm level is maintained throughout the soak period, there is a danger that a resistant strain or strains of microbes will be produced. Using the Conidia test provides inspection and maintenance engineers with real time monitoring information on the state of the tank on which to base decisions on the application of biocide. Time and money is saved by avoiding unnecessary and potentially damaging prophylactic biocide treatment. As the test takes only 10 minutes to carry out it is now also possible to test fuel deliveries for microbial contamination prior to uploading, so avoiding possible cross contamination of tanks.

DOES FUELSTAT® HAVE ANY REACTION WITH THE BIOCIDES?

The process of the test is unaffected by the presence or absence of biocide. However, if FUELSTAT[®] results indicate the need for biocide application, there should be a delay (as indicated by the manufacturer's instructions) between application and retesting. This is to ensure that the biocide has been completely effective. Retesting one week after the biocide has been introduced into a contaminated tank is recommended.

HOW MANY TESTS DO WE NEED TO TEST OUR FUEL TANKS?

One test per tank is required in any monitoring regime. Maintenance and inspection engineers will establish the frequency of testing by means of a risk assessment. The recommendations set out in the IATA Guidance Material on Microbiological Contamination in Aircraft Fuel Tanks are for a minimum frequency of once a year. Maintenance and inspection engineers may vary this according to their risk assessment. The risk may be considered higher, and so more frequent testing may be required, between the Tropics for instance. If operating in a high risk area, frequency of testing could be increased to 3 monthly or even to a monthly basis. It is considered unnecessary to test more frequently than monthly. Conidia Bioscience recommends that this frequency and risk assessment process is also carried out by diesel users. Conidia offers a consultancy service to assist with conducting these risk assessments where required.

IS ANY OTHER SPECIALIST EQUIPMENT REQUIRED?

FIJELSTAT® is intended to be "stand-alone". A clean container to collect the sample and usual safety equipment such as gloves are all that is required.



MATERIAL SAFETY DATA SHEETS

Material Safety Data Sheets can be supplied on request or may be downloaded from the website.

APPROVALS & TRIALS

Please visit www.conidia.com for a full list of organisations which have granted approvals or accreditations to **FUELSTAT®** products. Organisations currently trialling Conidia Bioscience's range of tests are also listed on the site.

PACKAGING

Each **FUELSTAT**[®] test is packed in a single heat-sealed foil pouch containing a test paddle, pipette, a sample extraction bottle, instructions for use and a desiccant sachet. Tests are normally dispatched in boxes of 8 but may be purchased individually.

Terminology: FUELSTAT[®] Test, indicates a single foil packed test. FUELSTAT[®] Kit, indicates a box of 8 individual tests.

MEMBERSHIP OF INSTITUTES & TRADE ASSOCIATIONS

Strategic Partner	IATA	International Air Transport Association
Member:	BMF	British Marine Federation
	AIDIS	Advancing UK Aerospace, Defence & Security Industries
	El	Energy Institute
	RHA	Road Haulage Association

PART NUMBERS AND NATO STOCK NUMBERS

- Part No FHR8 for pack of 8 FUELSTAT® RESINAE tests NATO stock number 4940-99-549-9623
- Part No FHR8-2 for a box of 8 FUELSTAT® RESINAE PLUS tests NATO stock number 4940-99-615-6295
- Part No FMD8 for the pack of 8 FUELSTAT® DIESEL tests NATO stock number 4940-99-907-9225

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CONIDIA BIOSCIENCE LTD

Bakeham Lane, Egham, Surrey TW20 9TY, UK Tel: +44 (0) 1491 829 102 Email: info@conidia.com

www.conidia.com

Registered in England at: 3 Acorn Business Centre, Northarbour Road, Cosham, Portsmouth, PO6 3TG. Registration Number: 03965471 Innovative Microbial Fuel Testing Strategic

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