

## Test passed – Detection of microbial contamination of car air-conditioning systems by means of the *airco well*® Sensor

### Microorganisms in car air-conditioning systems

Microorganisms that multiply over time can exist in car ventilation and air-conditioning systems (VAC systems). If present in sufficient concentration, these microorganisms form unpleasant odours and can impair the well-being, and possibly even the health, of the vehicle occupants. Especially if, after the input of organic substances, air-conditioning systems are unused for a lengthy time in conditions of high humidity and mild temperatures. It is presumed that microorganisms use organic trace elements that have accumulated in the air-conditioning system as nutrients.

### The *airco well*® Sensor

With its *airco well*® Sensor, TUNAP GmbH & Co. KG has developed a highly selective detector for gaseous substances, with which the volatile organic compounds (MVOCs) formed by microorganisms can be recorded. The “electronic nose” is based on a triple-layer sensor technology and is intended to be used for early detection of hygienically undesirable colonisation of car air-conditioning systems and to record the success of cleaning measures.

### Testing the *airco well*® Sensor

The purpose of the testing by bifa is to clarify whether the *airco well*® Sensor can be used to detect microbial contaminations and odorous substances, which are released by microorganisms that regularly exist in contaminated car air-conditioning systems.



To this end, bacteria (*Methylobacterium*, *Sphingomonas*) and fungi (*Penicillium*, *Candida*) frequently registered in car air-conditioning systems with noticeable odours were incubated in concentrations customary in practice ( $10^7$  –  $10^{10}$  bacteria and  $10^6$  –  $10^9$  fungi per batch). They were stored at room temperature for up to 262 hours in a low-odour culture medium. The batches were then flowed through with air and the exiting air was analysed using the *airco well*® Sensor.

### Test organisms used

Test organism	Origin/strain	Culture
<i>Sphingomonas melonis</i>	DSM 14445	30 °C, NAR agar
<i>Methylobacterium aquaticum</i>	Isolate of bifa culture collection	30 °C, NAR agar
<i>Candida parapsilosis</i>	Isolate of bifa culture collection	25 °C, DG 18 agar
<i>Penicillium citrinum</i>	DSM 1997	25 °C, DG 18 agar



Measurement of the test organism solution with the *airco well*® Sensor



Glass attachment with integrated triple-layer sensor

### Test procedure

The *airco well*® Sensor was placed in humidified air during its 15 second calibration phase. The air that flowed through the test batches at the time of measurement was ultra-pure, synthetic air humidified with ultra-pure water. By flowing through the test batches, the test air was enriched with the volatile compounds formed by the microorganisms, which then impinged on the *airco well*® Sensor.

### Result

Low measured values of 477 units on average were obtained in the test setup for uninoculated, low-germ control batches. Measured values of up to 687 units were registered for the batches inoculated with the test bacteria (*Methylobacterium/Spingomonas*).

The *airco well*® Sensor was able to detect microbial contaminations and odorous substances formed by bacteria, which regularly exist in comparable concentrations in car air-conditioning systems with noticeable odours.

*Candida* yeast, which more often exists in car air-conditioning systems with noticeable odours, also produced volatile compounds. The result achieved here confirms that the *airco well*® Sensor also detected the volatile compounds formed by yeasts, such as those that frequently exist in contaminated car air-conditioning systems.

### Test passed

The used test setup demonstrates that the *airco well*® Sensor is able to register the MVOC formed with different concentrations by test organisms.

The findings confirmed that the *airco well*® Sensor can be used to detect the volatile compounds that exist in air-conditioning air, and which are emitted by microorganisms that are frequently found in air-conditioning systems.

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