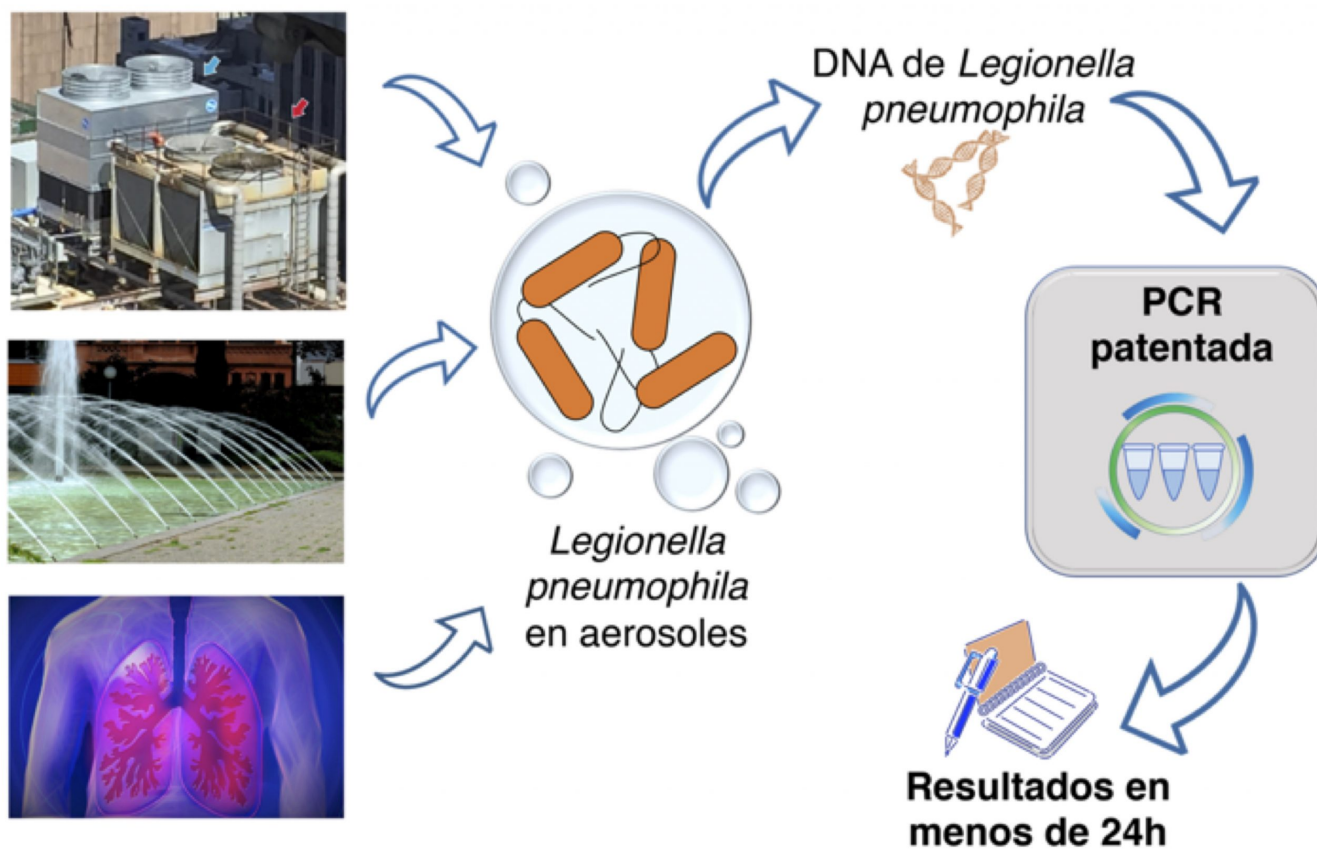


LegionAir-Detect: Method for detecting Legionella pneumophila in aerosols

Molecular method based on polymerase chain reaction (PCR) for detecting Legionella pneumophila bacteria in environmental (air, water, etc.) or clinical samples, in less than 24 hours.



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Technological Offers type

Technological solutions

Research and innovation areas

- Bioeconomy, Biotechnology and Food Systems
- Health and Wellbeing
- Security, Defense and Disaster-Resilience

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Keywords: | [Aerosol](#) | [Air quality](#) | [Bacterium](#) | [Health](#) | [Illness](#) | [Legionella](#) | [legionellosis](#)

Legionnaires' disease, also known as legionellosis (pneumonia accompanied by fever, cough and muscle pain) is caused by inhalation of the bacterium *Legionella pneumophila*, present in aerosols generated by artificial water systems (cooling towers, shower heads, hydromassage baths, etc.) and associated with a mortality rate of ~10%.

Our technology is able to detect the bacterium quickly in a wide variety of samples (air, water, clinical material, etc.) using DNA-based molecular techniques, significantly reducing the time needed to get results as compared to traditional methods (microbial culture) and therefore allowing the appropriate corrective or control measures to be applied sooner.

Description of the technological basis

Compared to the current system for detecting *Legionella pneumophila* (using microbial culture), which requires up to 15 days to be confirmed, our method provides reliable results in less than eight hours. Based on polymerase chain reaction (PCR) technology, its fundamental feature lies in the design of highly specific primers for *Legionella pneumophila* DNA. The method consists of two consecutive PCRs: an initial reaction intended to increase the quantity of bacterial DNA present in the sample; and a second reaction that specifically detects the presence of the DNA of that bacterium in the sample.

Business needs / application

'Spain is one of the European Union countries with the highest number of legionellosis cases'

Health

More than 10,000 cases of legionellosis were reported across the European Union in 2019, with Spain being one of the countries with the highest number of cases. Spain France, Italy and Germany together accounted for more than 70% of the total. It is estimated that the healthcare expenditure resulting from the disease amounts to €165 million per year in the EU. Early detection of outbreaks is critical in preventing new cases. The bacterium is transmitted by means of infectious aerosols present in the air, and our method has proven effective in detecting it based on samples of that kind.

In contrast to the periods currently needed for detection and confirmation (7 to 15 days), our technology offers results in less than 24 hours.

'The prevention and control of legionellosis in Spain is of particular interest and is regulated in Royal Decree 865/2003'

Biotechnology

Molecular techniques have proven more useful and effective than other, traditional methods. In the case of legionellosis, the regulations provide for its detection by means of microbial culture, which lengthens times and increases costs, in terms of both staff and materials.

Our invention applies the existing PCR technology for the early detection of airborne pathogens, using samples of filtered air or of some other kind, offering great versatility. The introduction of this innovative method could, in time, replace culture methods and significantly reduce costs.

Security, defence and resilience

Our method offers the flexibility to analyse different types of samples, not only water samples as per regulation. Having proven its effectiveness using filtered air samples, we have opened up the possibility of continuous sampling in urban areas, rather than spot sampling requiring access to buildings. This would make it possible to detect potential sources of the bacterium very quickly.

Competitive advantages

- Results in less than 24 hours, compared to the 7 to 15 days needed for the current culture system.
- Ability to study various samples (even more than 100) in the same batch analysis.
- Adaptable to different sample types: proven to be effective with air samples, which represents an innovation, since the medium in which the bacterium is transmitted is analysed directly.

'LegionAir-Detect offers a significant reduction in the time needed to obtain results'

Past performance references

The BIOMAT group at the Universidad Politécnica de Madrid has more than 30 years' research experience. It is a multidisciplinary group in which biologists, pharmacists and physicists work together, looking for solutions to the current needs of society and science. The BIOMAT group has had more than 100 articles published and several patents granted, including, recently, for the method presented here. That method makes it possible to detect the bacterium *Legionella pneumophila* in different types of samples (environmental, clinical, etc.) in a very short space of time (< 24h). Although the patent is available for anyone to consult, the BIOMAT group has also published a scientific article ([click here](#)) where the details, the efficacy and the real-world results obtained with the method for detecting the *Legionella* bacterium are presented. Those real-world results were obtained using various samples of air collected in the city of Madrid, Spain. Air samples are composed of different types of particles, including numerous microorganisms of different kinds (bacteria, viruses, fungal spores, etc.). Despite their great diversity, the total quantity of DNA in the samples was very low: < 0.280 $\mu\text{g}/\text{L}$, where the bacterium *Legionella pneumophila*, if it was present in the sample, represented less than 0.3% of the genetic sequences detected. Nevertheless, the method presented here was able to detect that bacterium in the samples that contained it. That means that, even where the quantity of genetic material is small, the method has a high degree of sensitivity for detecting the *Legionella pneumophila* bacterium.

Protection

- **Patent granted in Spain (ES2702117B2)**

Stage of development



