Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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(VOCs) in aqueous and gaseous environments. VOCs are pollutants of high prevalence in the air, and surface and groundwater. They are emitted from products such as paints, cleaning agents, pesticides, building materials and furnishings, office equipment and craft materials.

A common VOC is benzene, with a maximum contaminant level, set by the US Environmental Protection Agency (EPA), of 5 µg/l in drinking water. Many VOCs are present at similar, very low concentrations, so effective sensors must accurately measure and discriminate very small mass changes.

‘We have been able to measure concentrations among the lowest levels that have been achieved using this type of resonant micro-sensor,’ noted Professor Brand.

‘While we have not achieved the required sensitivity yet, we are constantly making improvements.’

Sensor tests

The researchers have tested their technology in the laboratory by pumping water with specific pollutant concentrations through a simple flow-cell device attached to the sensor.

A typical test begins by flowing a water sample, containing a known amount of pollutant, over a sensor coated with a polymer membrane. When the sample flows through the cell, the mass of the microstructure increases, causing its characteristic vibration frequency, or resonance frequency, to decrease. By monitoring this resonance frequency over time, the scientists can detect the amount of aromatic hydrocarbons (such as benzene) present in water.

The researchers plan to run field trials to investigate the use of this new micro-sensor in aqueous and gaseous environments for rapid on-site screening of multiple pollutants.

‘With benzene and other VOCs high on the EPA’s priority pollutant list, it would be a major advantage to get a rapid reading of VOC concentrations directly in the field,’ concluded Professor Mizaikoff.

(Details of this research, which is funded by the National Science Foundation, were presented at the American Chemical Society’s 234th National Meeting, which was held during 2007 in Boston, Massachusetts, USA.)

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Membrane technology could play a part in finding a cure for HIV

Scientists in Australia have completed initial research on specially designed ceramic membranes that have the potential to remove viruses from water, air and blood. They say, as this brief feature shows, that membrane technology could play an important role in saving the lives of millions of people.

In the future it may be possible to remove from blood the human immunodeficiency virus (HIV), a retrovirus which causes acquired immune deficiency syndrome (AIDS), saving the lives of millions of people, according scientists working at Queensland University of Technology (QUT) in Australia.

Ceramic membranes

The researchers at the university say that they have developed specially designed ceramic membranes for nanofiltration (NF), which have the potential to remove viruses from water, air and blood.

Associate Professor Huai Yong Zhu, from QUT’s School of Physical and Chemical Sciences, has led the development of these membranes, also known as a nano-mesh, and says that preliminary research had proved it successful in removing viruses from water.

In a news report from QUT, published during 2007, Dr Zhu said: ‘If we can remove compounds from liquids and viruses from water, then there also may be potential to remove HIV from blood.’

Failing

According to Dr Zhu, current ceramic membranes were unable to permit high filtration flux or flow, and at the same time effectively filter out unwanted particles or viruses.

He says another failing of current membranes is they often form pin-holes and cracks during the fabrication process, resulting in wasted material.

With these problems in mind QUT researchers introduced radical changes to the membrane texture because they say it is the membrane texture which is crucial to the separation efficiency of the material.

Mesh structure

Scientists agree that a mesh structure is the most efficient form for filtration applications.

The researchers at QUT claim that they are the first group to successfully create such a structure on a nanometre scale with ceramic fibres.

‘This modification has increased the rates of flow that pass through the membranes by at least 10 times, compared with current ceramic membranes, while maintaining the efficiency of capturing over 96% of the unwanted particles,’ said Dr Zhu.

Water and air

In the report, the scientists say that the membranes, which have been patented by QUT, are not solely restricted to blood filtration and also could be used to filter water and air.

For example this technology could be used to filter airborne viruses such as the Severe Acute Respiratory Syndrome (SARS) and the avian flu virus, both of which are a major concern to the international community.

Because the membrane has been designed to permit a large flux or flow, it also could be used for water treatment, and used by the pharmaceutical and food industries.
**Abundance**

Another benefit of the technology is that the alumina and titania nano-fibres are made from compounds produced in abundance in Australia.

‘It is literally home-grown technology. Titania is a compound found in beach sand and alumina is an intermediate product of aluminium which is the third most abundant element in the earth’s crust,’ said Dr Zhu.

‘Australia is the largest producer of alumina and titania in the world which means we can make nano-mesh relatively easily and cheaply.’

**Industry partner**

The future of nano-mesh relies on attracting an industry partner interested in developing the technology into a commercial product.

‘We have proven the technology works, so the initial research has been done,’ said Dr Zhu.

‘We now need a partner to come on board and help us develop this technology into a product that has the potential to save the lives of people with HIV.’

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**ePTFE membrane filter media improve plant performance**

A manufacturer of dye-stuffs for the ceramics industry is seeing a marked improvement in the performance of its plant after replacing existing bag filters with ones that contain media produced by Donaldson Membranes. The polyester needlefelt material, which has a Tetratex expanded polytetrafluoroethylene membrane surface, maintains a low pressure drop and extends the service life of the bags, as this case study reveals.

Donaldson Membranes’ expanded polytetrafluoroethylene (ePTFE) membrane media has given a new lease of life to a filter employed in the production of dye-stuffs for the ceramics industry at Colores Cerámicos, which is based in Castillon, Spain.

Colores Cerámicos, an expert producer of dye-stuffs and serigraphy for use in the ceramics industry, is committed to ongoing research and development to ensure maximum performance of its manufacturing processes. As part of this drive for continuous improvement, it chose to optimise the performance of a bag filter used in a spray dryer process.

**Clogged fabric**

The fine enamel powder dust produced at the spray dryer was able to penetrate the filter media, clogging the fabric, and causing a high pressure drop across the filter. This was leading to reduced production rates and a useful bag life of less than four months, says the Spanish company.

Donaldson Membranes was asked to inspect the filter, which contains 176 bags with a filtration area of 180 m², manufactured from conventional, glazed surface polyester needlefelt.

Cleaning is achieved by a pulse jet, dust loading is 60 g/m³ and the air/cloth ratio is 0.83 m/min. The operating temperature is 120–130°C, with a peak of 133°C.

**Replacement**

Donaldson Membranes’ Sales Manager for Iberia, Jordi Ezquerro, proposed that the previously installed filter bags were replaced with ones manufactured from Donaldson Membranes’ polyester needlefelt material that has a Tetratex ePTFE membrane (Figure 1) surface.

The filter bags, made by Spanish bag maker ACMA are still working to desired performance levels after more than 24 months in operation – an excellent improvement in bag service-life compared with the life of the previous bags, say the companies. The pressure drop is maintained below 150 mm w.c., and emission levels are well below the required 20 mg/Nm³.

**Confident**

Ezquerro commented on the installation: ‘We were confident that our media would solve the problem of bag fabric clogging and would extend the useful life of the filter bags – and Tetratex No. 6214 has proved to be a successful solution to the problems.’

Angel Badenas, Production Manager at Colores Cerámicos, is pleased with the results, and added: ‘We are extremely satisfied with the performance of these filter bags. The results, after more than 24 months, have completely fulfilled expectations from both a lifetime and performance point of view.’

These high performance laminates offer superior dust cake release, high air flow, low pressure drop and high efficiency (Figure 2), making Tetratex an excellent choice for filtration and other applications, says Donaldson Membranes.

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**Figure 1. Donaldson Membranes’ expanded polytetrafluoroethylene (ePTFE) membrane media.**

**Figure 2. Donaldson Membranes’ expanded polytetrafluoroethylene (ePTFE) membrane media maintain a low pressure drop, improve bag service life and have a high filtration efficiency.**