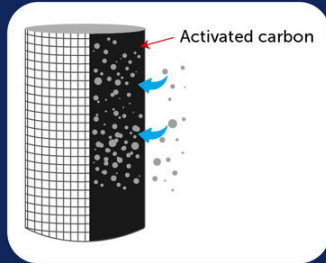


Researchers create new low-cost, sustainable material for reducing air and water pollution

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A New Affordable and Sustainable Hybrid Material to Reduce Air and Water Pollutants

Current gold standard adsorbent




- ✓ High adsorption
- ✗ Expensive
- ✗ Disposal of end-of-life sorbent
- ✗ Poor regeneration

What is a suitable alternative?

Synthesis



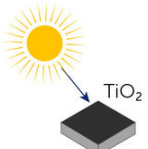
Benefits of new hybrid material



3D printing
 Used for water filtration


Particulate matter trapping
 Reduced air pollution


Sustainable
 Lower carbon footprint


Adsorption
 High organic dye adsorption efficiency


Photodegradation
 Good photodegradation performance with titania coating


Flexible application
 Brush, coat, spray or 3D-print



A new class of sustainable hybrid materials made from solid wastes and naturally abundant polymers can reduce water and air pollution more efficiently than activated carbon

Overview of the study methods and results, which demonstrate a new low-cost, sustainable material for reducing air and water pollution. Credit: © 2018 Zanoletti, Vassura, Venturini, Monai, Montini, Federici, Zacco, Treccani and Bontempi. *Front. Chem.* | doi: 10.3389/fchem.2018.00060

A new class of low-cost and sustainable hybrid materials could possibly displace activated carbon as the preferred choice for reducing wastewater and air pollution. The material, described in *Frontiers in Chemistry*, is synthesized inexpensively from solid wastes and a naturally abundant polymer—and can cut down pollutants in air and wastewater with more success than activated carbon, the current gold standard adsorbent.

"This paper shows the simple synthesis of a new porous hybrid material, obtained by using low cost and by-product [materials](#)," says the lead author, Dr. Elza Bontempi from the University of Brescia, Italy. "The material was designed on the basis of The European Commission's request to develop an affordable, sustainable and innovative design-driven material solution that can reduce the concentration of [particulate matter](#) in urban areas."

Particulate [matter](#)—solid particles and liquid droplets found in the air and emitted from power plants, industry, automobiles and fires—is ubiquitous in cities and even the countryside. Moreover, millions of tons of industrial effluents are released into the world's waters every year. Both particulate matter and organic dyes are highly toxic to ecosystems and to humanity.

Activated [carbon](#) is the most common adsorbent used to reduce both

atmospheric and [wastewater](#) pollution—but is expensive to produce and regenerate. The challenge has been to find an economical alternative.

In the new study, researchers combined a naturally abundant raw material, sodium alginate (a polysaccharide that can be extracted from seaweed and algae) with a high-volume industrial by-product, silica fume (a by-product of ferrosilicon or silicon metal alloy processing) to produce a "green" adsorbent that is better than activated carbon.

"The article reports preliminary results about the new material's capability to capture particulate matter," says Dr. Bontempi. "It can also be used for wastewater remediation. In particular, its ability to replace activated carbon is demonstrated."

The synthesis method is simple and easy to scale up. Taking advantage of the gelling properties of alginate, the researchers combined it with the decomposition of food-grade sodium-bicarbonate (baking soda) to consolidate the material. Testing of wastewater pollution was performed using methylene blue dye as a model pollutant. The hybrid material adsorbed and removed the dye, even at high concentrations, with 94% efficiency.

Analyses revealed that, compared with activated carbon, production of the [hybrid material](#) consumed less energy ("embodied energy") while leaving a much lower carbon footprint. The material also demonstrated encouraging capabilities for trapping diesel exhaust fume particulate matter.

The material can be applied as a coating, used for spraying or brushing, and used for 3D-printing. This means it could be used to cover external building surfaces to remove particular matter, as well as to design water filtration units.

This versatility is an exciting new addition to humanity's toolkit for reducing air and water pollution.

More information: Alessandra Zanoletti et al, A New Porous Hybrid Material Derived From Silica Fume and Alginate for Sustainable Pollutants Reduction, *Frontiers in Chemistry* (2018). [DOI: 10.3389/fchem.2018.00060](https://doi.org/10.3389/fchem.2018.00060)

Provided by Frontiers

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