

NEW
NOW AVAILABLE
ONLINE & ON IPAD



Read issues and enjoy bonus interactive features on iPad plus:

- ▶ Save up to 44%
- ▶ Browse over 200 issues online
- ▶ Access digital issues a week before they hit the newsstand

SCIENTIFIC AMERICAN | **DIGITAL**

SUBSCRIBE & GET INSTANT ACCESS ▶

SCIENTIFIC AMERICAN™

[Sign In / Register](#)



Subscription Center

[Subscribe to Print & Tablet »](#)

[Subscribe to Print »](#)

[Give a Gift »](#)

[View the Latest Issue »](#)



- Subscribe
- News & Features
- Topics
- Blogs
- Videos & Podcasts
- Education
- Citizen Science
- SA Magazine
- SA Mind
- Products

Technology :: News :: May 7, 2013 :: 9 Comments :: [Email](#) :: [Print](#)

More from Scientific American

MIND »



Classics »



DIGITAL »



Includes tablet edition!

Cheap Nanotech Filter Clears Hazardous Microbes and Chemicals from Drinking Water

A \$16 device could provide a family of five with clean water for an entire year

By [Luciana Gravotta](#)

About 780 million people—a tenth of the world’s population—do not have access to clean drinking water. [Water](#) laced with contaminants such as bacteria, viruses, lead and arsenic claims millions of lives each year. But an inexpensive device that effectively clears such contaminants from



water may help solve this problem.

Thalappil Pradeep and his colleagues at the Indian Institute of Technology Madras developed a \$16 nanoparticle water filtration system that promises potable water for even the poorest communities in India and, in the future, for those in other countries sharing the same plight. Although cheap filtration systems have been developed previously, this is the first one to combine microbe-killing capacity with the ability to remove chemical contaminants such as lead and arsenic. Because the filters for microbes and chemicals are separate components, the system can be customized to rid water of microbial contaminants, chemical contaminants or both, depending on the user's needs.



[Pin it](#)

About one-tenth of the world's population does not have access to clean drinking water.

Image: iStockphoto/vijaya_5712

SCIENTIFIC AMERICAN™

Best Offer
for BOTH
Print + Tablet
Editions



SUBSCRIBE TODAY! 

Apple and iPad are trademarks of Apple Inc., registered in the U.S. and other countries. App Store

More to Explore

[Valley Fever Throws Baseball a Curve](#)

[Springtime Science: Exploring the Pigments in Flowers](#)

[Could a Neural Implant Correct Errant Thoughts?](#)

[Big Data Needs a Big Theory to Go with It](#)

[Hanford Nuclear Waste Cleanup Plant May Be Too Dangerous](#)

Latest News

NEWS | 25 minutes ago

[Valley Fever Throws Baseball a Curve](#)

CLIMATEWIRE | 40 minutes ago

[Cleaner, Cheaper Way to Make Steel Uses](#)

Most Read



A prototype of the filtration system. *Credit: Thalappil Pradeep, Indian Institute of Technology Madras*

In a [report published yesterday](#) in *Proceedings of the National Academy of Sciences*, Pradeep and his collaborators explain that the microbe filter relies on silver nanoparticles embedded in a cage made of aluminum and chitosan, a carbohydrate derived from the chitin in crustacean shells. The cage blocks macroscale water contaminants as well as protects the nanoparticles from sediments that would otherwise accumulate on their surfaces, thereby preventing them from releasing microbe-zapping ions.

The team used nanoparticles that release iron- and arsenic-trapping ions to make its chemical filter. But Pradeep notes that the “cage” technique can be used with other

Electricity

MIND GUEST BLOG | 3 hours ago

[Human brain cells alive in mouse brains.](#)

GUEST BLOG | 3 hours ago

[Some Facets of the Geology of Diamonds](#)

SCIENTIFIC AMERICAN MIND | 3 hours ago | 2

[Could a Neural Implant Correct Errant Thoughts?](#)

Follow Us:



See what we're tweeting about
Scientific American Editors



JenLucPiquant Ally Brosh is back with Depression Pt II: "It isn't even something — it's nothing. And you can't combat nothing." <http://t.co/g3zlsbNTbi>

2 minutes ago · reply · retweet · favorite



DNLee5 Only \$13K & some change to go. Let's get #ExpDenali funded. <http://t.co/Czy8iVZVSR>

3 minutes ago · reply · retweet · favorite

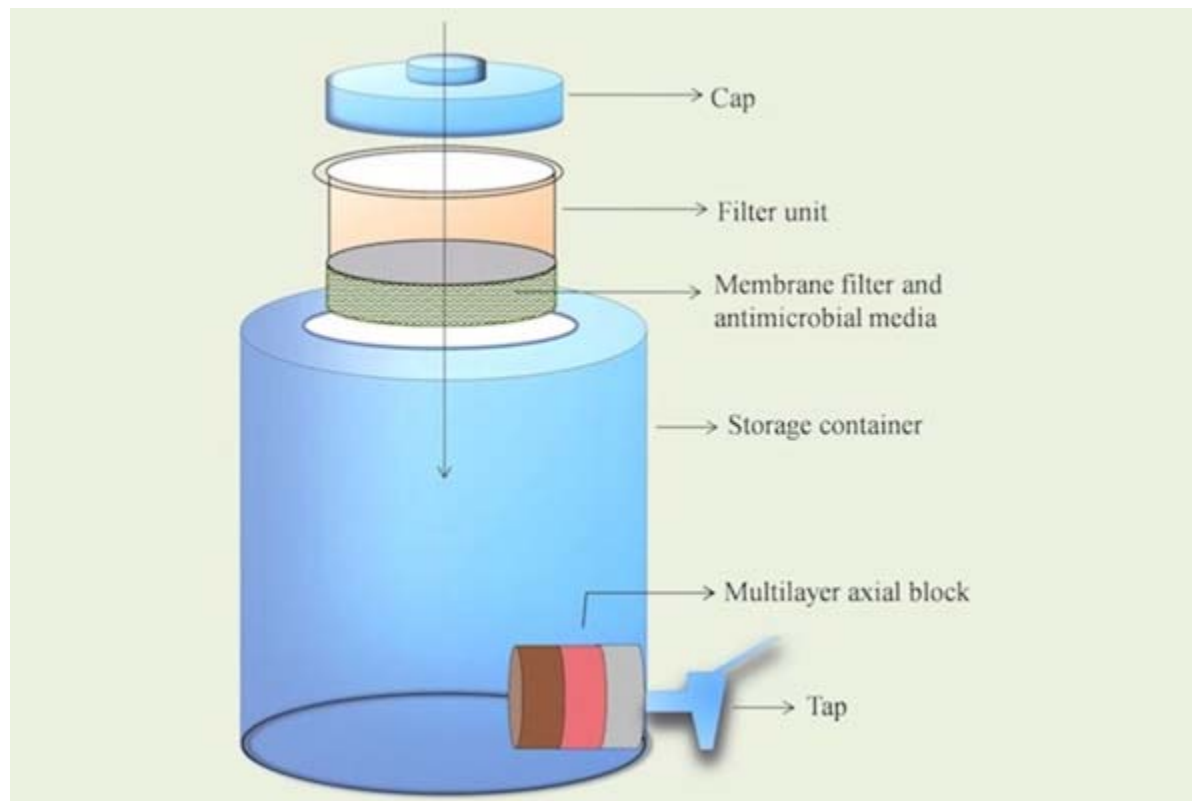


notscientific How you can teach your child the alphabet while talking about birds. By @GrrlScientist <http://t.co/dL2qRqB64Y> #scilogs

5 minutes ago · reply · retweet · favorite

[More »](#)

nanoparticles to target contaminants such as mercury.



The membrane filter at the top kills bacteria and viruses, and the axial block at the bottom can be custom fitted with a second filter for lead or arsenic. *Credit: Thalappil Pradeep, Indian Institute of Technology Madras*

The materials are added one by one into water and self-assemble into small sheets that resemble clay (see image below). These sheets are the “cages” that then hold on to the silver nanoparticles. Production requires no electricity because the claylike filters are made at room temperature. Every liter of water used to make the material goes to filtering 500 liters of water. “This is a room-temperature green synthesis, which means it can be deployed in any part of the world,” Pradeep says.

Free Newsletters

Get the best from Scientific American in your inbox

Solve Innovation Challenges

Identify Organisms from a Stream of DNA Sequences



Deadline: May 31 2013
Reward: **\$1,000,000 USD**

This is a **Reduction-to-Practice** Challenge that **requires written documentation** and&

Chemical Approaches for the Degradation of a Pesticide in a Dilute Aqueous Solution



Deadline: Jun 29 2013
Reward: **\$7,000 USD**

The Seeker for this Challenge desires proposals for chemical methods that could rapidly degrade a dilute aqueous solution

[More Challenges >>](#)

Powered By: **INNOCENTIVE**

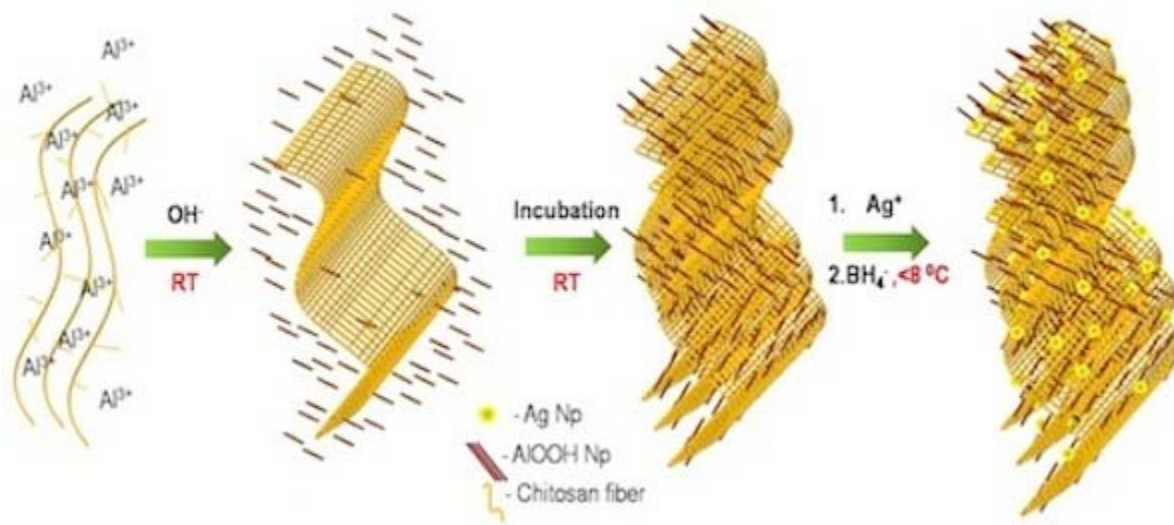
NEW! DIGITAL SUBSCRIPTIONS INCLUDE IPAD ACCESS!

Read issues, enjoy exclusive videos, bonus interactive features, audio interviews & more.

SCIENTIFIC AMERICAN | DIGITAL

SUBSCRIBE NOW!

Latest from SA Blog Network



Chitosan fibers combine with aluminum hydroxide nanoparticles (Al(OH)₃ Np) to form a claylike “cage” that can protect embedded silver nanoparticles from deposits that would reduce their microbe-killing power. *Credit:*

Thalappil Pradeep, Indian Institute of Technology Madras

“This is probably the strongest aspect of the study,” says John Georgiadis, professor of bioengineering at the University of Illinois at Urbana–Champaign. “Other systems are very expensive and have very low green profiles.”

James Smith, professor of environmental and civil engineering at the University of Virginia called the new work “promising and exciting” but foresees problems with the filter’s production in countries like India and Africa. “The method involves both strong acids and bases and likely would not allow for manufacturing in a developing-world setting,” Smith commented via e-mail. Depending on how high the region’s contamination levels are, the filter must be boiled in water for about four hours every six months to remove deposits that reduce nanoparticle potency. According to Smith, this cleaning may be “difficult for developing-world families to accomplish on a regular basis.” Smith is the co-developer of PureMadi, a clay filtering pot coated with nanoparticles that gets rid of harmful bacteria—but not chemicals—in

Human brain cells alive in mouse brains.

MIND MIND Guest Blog | 3 hours ago

Some Facets of the Geology of Diamonds

Guest Blog | 3 hours ago

Equality and Individuality: A Collaboration Between Primates

The Primate Diaries | 7 hours ago

Exclusive Sneak Preview of Metamorphic Madness

Rosetta Stones | 10 hours ago

Build a Bricks & Mortar SciArt Gallery - right now!

Symbiartic | 11 hours ago



water that is currently being used in South Africa.

1 2 Next »

[Reprints and Permissions »](#)

Like 239

Tweet 23

54

Share 12

+ reddit this!

9 Comments

[Add Comment](#)

1. lamorpa

03:46 PM 5/7/13

Invention of the year!

[Reply](#) | [Report Abuse](#) | [Link to this](#)

2. Acoyauh2

04:51 PM 5/7/13

Boiling the filter every six months seems like too much for Mr. Smith? In Mexico isolated communities have to boil ALL their water, as I assume they have to do elsewhere. And, boiling does not remove chemical contaminants.

I think mr. Smith just dislikes competition...

Awesome invention, hope mr. Predeep does manage to make it viable - maybe try to recruit some WHO/FAO support, or so?

[Reply](#) | [Report Abuse](#) | [Link to this](#)

3. Tanmay

05:45 PM 5/7/13

Lol, Smith is such a sore loser.

The set up is so simple, I could assemble it at home if I had the



NEW! DIGITAL SUBSCRIPTIONS INCLUDE IPAD ACCESS!

Read issues, enjoy exclusive videos, bonus interactive features, audio interviews & more.

SCIENTIFIC AMERICAN DIGITAL

SUBSCRIBE NOW!

News From Our Partners

 REUTERS

Sentencing set for activists who broke into Tennessee nuclear site

 nature

Fears grow over Australian science funding

 FAST COMPANY

This Infographic Is The 21st Century's Quickest Economics Class

 tech media NETWORK

Meteor Shower from Halley's Comet Peaks This Weekend

 ClimateWire

Cleaner, Cheaper Way to Make Steel Uses Electricity

 c|net

DOJ: We don't need warrants for e-mail, Facebook chats

Science Jobs of the Week

chemicals.

Strong bases and acids make it hard to manufacture in developing countries ??? Makes no sense. Strong bases and acids are not "advanced" technology lol.

People have been using strong acids and bases all over the world, since the beginning of time !

Really Smith, really !?

[Reply](#) | [Report Abuse](#) | [Link to this](#)

4. toffer99
02:35 AM 5/8/13

I have a suggestion for the manufacturers. Import these to areas of the US where fracking takes place. You'll sell millions.

[Reply](#) | [Report Abuse](#) | [Link to this](#)

5. Wisarut
05:31 AM 5/8/13

Wow. In my opinion, I think that all people around the world will satisfy with this scientific breakthrough. This is because there is something miracle that people for a long time have been craving for. Fresh water with free contaminants and eliminated microbes would be advantageous for suffering people. According to the limitation dealing with the filter usage, we need to consider applying them on a case-by-case basis. Certainly, the amount of arsenic polluting in the groundwater wells or rivers differs from other place to one another. We need to adjust ourselves to changing circumstances to the level that we can survive during harsh environment such as in both Africa and India. This is an onset experiment in which scientists must have done for us. The

Full Professorship (W2) for Molecular Microbiology
Johann Wolfgang Goethe University Frankfurt

Postdoctoral position in membrane protein structural biology with NMR
University of Basel, Biozentrum

Technical Assistant
CeMM Research Center for Molecular Medicine of the Austrian Academy of Sciences

[More jobs from Naturejobs.com >](#)



release of products in bulk needs to manage properly so that the chronic pain of those people will resolve as soon as the managers of some factories can distribute this kind of device to remote areas thanks to inexpensive and handy equipment.

[Reply](#) | [Report Abuse](#) | [Link to this](#)

6. stargene
05:40 AM 5/8/13

Good article and good comments.

Question:

What would it take, in principle, to scale up such an approach to remove the massive amounts of mercury, say, in the Arctic Ocean, which is causing wholesale decline of species on land and sea? Or, another example, the chemicals which are causing unprecedented algal blooms in Lake Erie, resulting in anoxic dead zones?

[Reply](#) | [Report Abuse](#) | [Link to this](#)

7. KFolger
06:15 AM 5/8/13

No mention is made of organic contaminants. In areas where those or particulate matter is a problem, would additional layers of filtering be required?

[Reply](#) | [Report Abuse](#) | [Link to this](#)

8. rahulhuk
02:40 PM 5/8/13

hey Luciana Gravotta, the person you address in your article is a professor at IIT Madras and holds a doctorate degree. You want to address academicians with such qualifications as Dr.(_____). Are you really a science article writer? lol

[Reply](#) | [Report Abuse](#) | [Link to this](#)

9. Carlos Solrac
in reply to **toffer99**
05:41 PM 5/8/13

Yes also to Washington DC where chemicals are added to water to trap lead.

[Reply](#) | [Report Abuse](#) | [Link to this](#)

Add a Comment

You must [sign in](#) or [register](#) as a ScientificAmerican.com member to submit a comment.

Click one of the buttons below to register using an existing Social Account.

Ads by Google

New sCMOS Camera

The first true scientific CMOS camera available now from Andor.
www.andor.com/scmos

2,3&4BHK flats@Metrozone

in Anna Nagar, Chennai from 1.63 cr
Prices increasing shortly
www.metrozone.in/heartofchennai

What Happens When You Die

New scientific theory says
death isn't the end
RobertLanza.com

Hair Fall Treatment

World's 1st Hair Stemcell Lab, Now
Guaranteed results. Visit Us Now!
DrNigams.net/Hair+Fall+Treatment

TRY A RISK-FREE ISSUE

YES! Send me a free issue of Scientific American with no obligation to continue the subscription. If I like it, I will be billed for the one-year subscription.



Email Address

Name

Scientific American is a trademark of Scientific American, Inc., used with permission

© 2013 Scientific American, a Division of Nature America, Inc.

All Rights Reserved.

[Advertise](#)

[About Scientific American](#)

[Subscribe](#)

[Special Ad Sections](#)

[Press Room](#)

[Renew Your Subscription](#)

[Science Jobs](#)

[Site Map](#)

[Buy Back Issues](#)



Continue

[Partner Network](#)

[Terms of Use](#)

[Products & Services](#)

[International Editions](#)

[Privacy Policy](#)

[Subscriber Customer Service](#)

[Travel](#)

[Use of Cookies](#)

[Contact Us](#)