

The Scaffolding Collaboration of Middle School and High school teachers and students of water filtration with the use of nanotechnology

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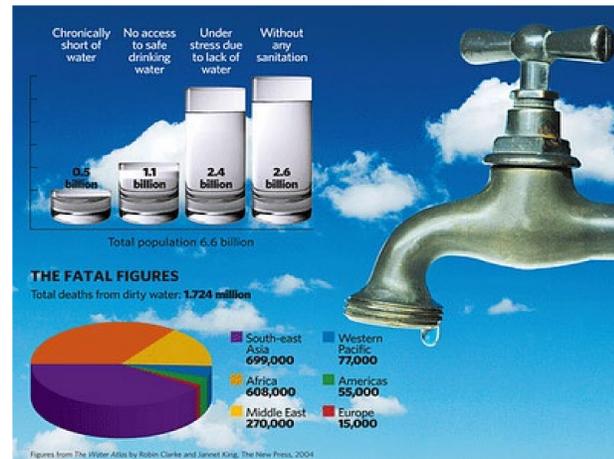
Nanosystems Engineering Research Center for
Nanotechnology-Enabled Water Treatment



ABSTRACT

6th grade students and environmental high school science students will collaborate in a water filtration experiment with the following objectives:

- Understanding the scarcity of access to clean water globally.
- Engineering and testing a water filtration system using common materials such as cotton balls, cheesecloth, zeolite, activated charcoal, sand and coffee filters.
- Understanding the importance of nanoparticles and how to use nanotechnology to reduce biofouling and enhance the lifespan quality of the filter.



“Some 1.1 billion people worldwide lack access to water, and a total of 2.7 billion find water scarce for at least one month of the year. Inadequate sanitation is also a problem for 2.4 billion people—they are exposed to diseases, such as cholera and typhoid fever, and other water-borne illnesses. Two million people, mostly children, die each year from diarrheal diseases alone” –WorldWildLife.org

THE SIMPLE FILTRATION SYSTEM

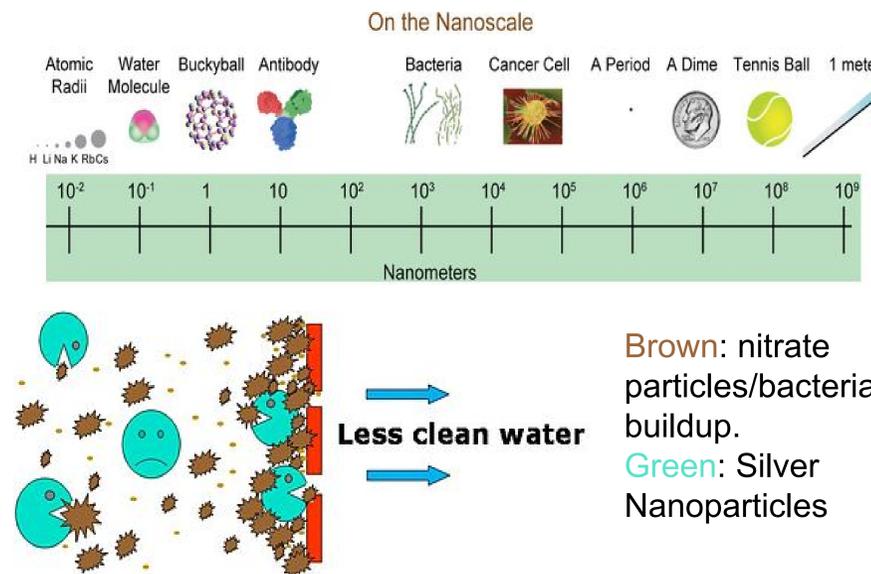
Students:

- engineer a filtration system using only cocktail cups, thumb tacks, and three out of six materials for filtration
- use colored water as a bacterium
- filter water through their design and examine the filtration’s results.
- redesign and test again to determine what materials filter the water the best.



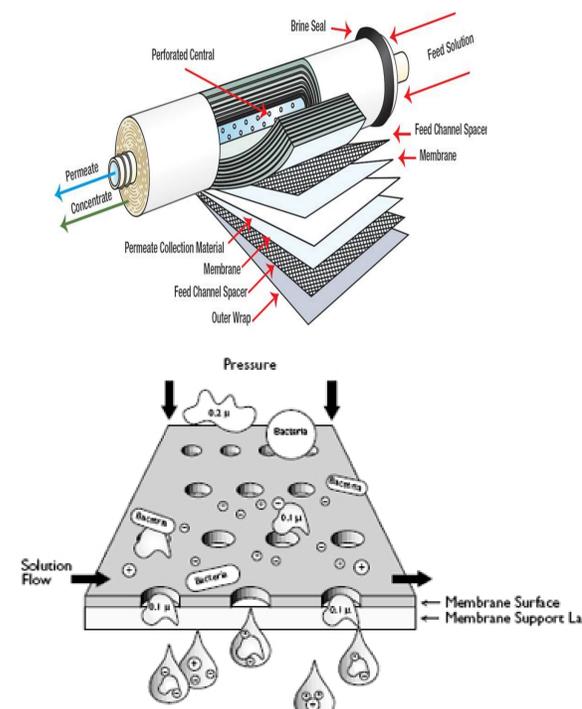
NANOPARTICLES AND REDUCING BIOFOULING

- Nanotechnology is “the development of atomic, molecular, or microscopic technology under 100 nanometers.”
- nanoparticles provide efficient water purification allowing third-world countries access to clean water
- membranes are prone to biofouling, where microbial growth on the membrane surfaces can result in a decrease in filtration, requiring cleaning and costly membrane replacement.
- silver nanoparticles coating on the membrane surface can minimize biofouling, while prolonging the membrane life.¹



ENHANCING A COMMON RO FILTER WITH SILVER NITRATE PAINT

- High school students will create a concentration of 3mM of silver nitrate (atomic size)
- An RO filter will be purchased from a local hardware store
- The membrane from the filter will be coated with silver nitrate paint to reduce biofouling.



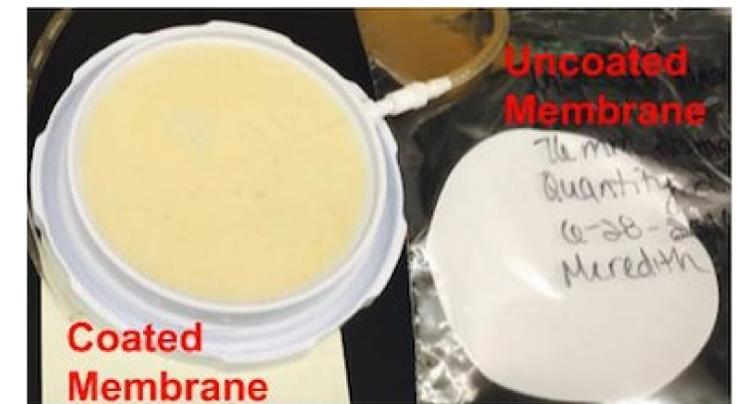
COLLABORATION

- Mountain Pointe High School students will travel to Centennial Middle School to collaboratively engineer a sophisticated filtration system using the membrane from the RO filter and silver nitrate painted membrane.
- High school-Middle school teams will use the membranes to filter colored water.
- Results will be compared to those of the simple filtration system.

ANTICIPATED PROJECTED RESULTS

It is expected that the silver nitrate coating of the membrane will extract the coloring from the water at a higher rate thus increasing the lifespan of the filter and quality of the filtered water.

Students will be able to compare and contrast this more enhanced system with the more simplistic system.



ACKNOWLEDGEMENTS

I would like to thank NEWT for providing this opportunity to participate in this research, Dr. Carberry for your availability and knowledge, Dr. Shahnawaz Sinha for his authorship in collaboration with Miss Meredith Morrissey, high school teacher at Mountain Pointe High School, Dr. Ganesh Tirupalavanam, Senior Sustainability Scientist at ASU and Concord Consortium for their water filtration activities.

References

1. Ben-Sasson, M., Lu, X., Bar-Zeev, E., Zodrow, K.R., Nejati, S., Qi, G., Giannelis, E.P., and Elimelech, M. "In situ formation of silver nanoparticles on thin-film composite reverse osmosis membranes for biofouling mitigation." *Water Research*, Volume 62, October 2014