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Mike BELOSOVIC, *et al.*
Ozone vs Prions

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Ozone-treated water can eradicate prions in the brain of infected animals

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A University of Alberta research team has discovered that technology commonly used to decontaminate food industry equipment can also rid meat processing plants of lethal microbial material responsible for the human version of the ailment Mad Cow disease.

U of A microbiology professors Mike Belosevic and Norm Neumann and engineering professor Mohamed Gamal El-Din demonstrated that infectious proteins found in the brain matter of cattle can be eradicated from water treated with ozone.

The discovery could have applications in decontaminating wastewater in settings such as slaughterhouse effluents where infected neural material known as prions may be present.

Cases of human transmission of infectious prions through surgical equipment have also been documented. The ozone decontamination procedure can potentially be used to sterilize instruments used for neurosurgery, and prevent the transfer of infectious prions during surgical procedures.

Prions have been identified as source of Mad Cow and Chronic Wasting disease in animals. The human variants or these conditions are Creutzfeld-Jakob disease and Alzheimer's disease. Prions are found in the brain and spinal cord tissue of infected animals and are a grave health risk in human and animal settings.

Prions are able to destroy and can still be infectious after being incinerated at heats of 850°C. In the wild, soil contaminated by a carcass of a deer that died of Chronic Wasting Disease can remain a source of infection for many years.

The U of A research team's technique of using water treated with ozone to destroy prions is an improvement on current prion decontamination methods.

University of Alberta

Killing prions with ozone

By
Richard Cairney and Kate Toogood

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(L-R) Mohamed Gamal El-Din, Ning Ding, Mike Belosevic and Norman Neumann

(Edmonton) When it comes to infectious agents, it doesn't get much worse than prions. These misfolded proteins are highly resistant to a wide variety of extreme disinfectant procedures. They have been identified as the culprits behind mad cow disease and chronic wasting disease in animals and humans, and are also implicated in Creutzfeldt-Jakob disease and other prion-related disorders.

But an interdisciplinary University of Alberta research team has come a step closer to finding a way of inactivating these highly infectious proteins.

The team, lead by environmental health professors Mike Belosevic and Norm Neumann from the School of Public Health and engineering professor Mohamed Gamal El-Din from the Department of Civil and Environmental Engineering, have demonstrated for the first time that prions are highly susceptible to molecular ozone.

The discovery could have implications for decontaminating medical and dental surgical instruments or treating water and wastewater in settings where prions might appear, such as in slaughterhouse waste.

"Although we know that they have a very high-level resistance, it's possible that we've discovered their Achilles' heel," said Neumann. "This means there might be simple solutions to dealing with contaminated medical instruments and waste products from slaughterhouses."

Human transmission of these devastating infectious agents through patient exposure to surgical equipment and blood transfusions has been documented. If these proteins can be neutralized, the result will be improved patient care.

"Because ozone is already commonly used in the hospital environment, the technology for this disinfection process already exists," says Neumann. "It is possible to take a medical instrument, put it in an ozone bath and very quickly destroy 99.99% of the prions that are there."

However, there is still much work to do. "The only proof of final inactivation is to actually infect animals, and it may take years for the animal to start demonstrating the behavioural changes associated with these diseases caused by prions," says Neumann. "We need more research in this area to increase our understanding of the relationship between ozone and all types of prions, including bovine spongiform encephalopathy or BSE, and that's what we're working on now."

The interdisciplinary nature of the research proved to be crucial to the success. "Nobody has really taken the biological diagnostics and methods and then applied them in the engineering context, and that's what we did here," Neumann said.

The importance of the interdisciplinary approach to this research is echoed by Gamal El-Din. "We have the expertise in microbiology and engineering to make a difference. The ultimate goal is to protect the health of people as well as the environment."

The research was funded in part by the Alberta Prion Research Institute, PrioNet Canada and the Natural Sciences and Engineering Research Council of Canada and published in the February issue of the journal Applied and Environmental Microbiology.

Links:

Mike's page:
http://www.publichealth.ualberta.ca/research/researchers_supersivors/faculty/belosevic.aspx

Norm's page:
http://www.publichealth.ualberta.ca/research/researchers_supersivors/faculty/neumann.aspx

Gamal El-Din's page:
http://www.civil.engineering.ualberta.ca/Research/ResearchAreas/Environmental/MohamedGamalElDin.aspx

Journal page:
http://aem.asm.org/content/78/3/613.abstract?sid=f6e5d382-1b83-4472-834e-e557b232ed57