

New filter promises clean water for millions

An ingenious invention is set to bring clean water to the third world, and while the science may be cutting edge, the materials are extremely down to earth.



A handful of clay, yesterday's coffee grounds and some cow manure the ingredients that could bring clean, safe drinking water to much of the third world.

The simple new technology, developed by ANU materials scientist Mr Tony Flynn, allows water filters to be made from commonly available materials and fired on the ground using cow manure as the source of heat, without the need for kiln. The filters have been tested and shown to remove common pathogens including E-coli.

Unlike other water filtering devices, the filters are simple and inexpensive to make.

"They are very simple to explain and demonstrate and can be made by anyone, anywhere," says Mr Flynn.

"They don't require any western technology. All you need is terracotta clay, a compliant cow and a match."

The production of the filters is extremely simple. Take a handful of dry, crushed clay, mix it with a handful of organic material, such as used tea leaves, coffee grounds or rice hull, add enough water to make a stiff biscuit-like mixture and form a cylindrical pot that has one end closed, then dry it in the sun. According to Mr Flynn, used coffee grounds have given the best results to date.

Next, surround the pots with straw, put them in a mound of cow manure, light the straw and then top up the burning manure as required. In less than an hour the filters are finished.

The properties of cow manure are vital as the fuel can reach a temperature of 700C in half an hour and will be up to 950C after another 20 to 30 minutes. The manure makes a good fuel because it is very high in organic material that burns readily and quickly; the manure has to be dry and is best used exactly as found in the field, there is no need to break it up or process it any further.

"A potter's kiln is an expensive item and can take up to four or five hours to get up to 800C. It needs expensive or scarce fuel, such as gas or wood to heat it and experience

to run it. With no technology, no insulation and nothing other than a pile of cow manure and a match, none of these restrictions apply."

It is also helpful that, like terracotta clay and organic material, cow dung is freely available across the developing world.

Just as using manure as a fuel for domestic uses is not a new idea, the porosity of clay is something that potters have known about years, and something that as a former ceramics lecturer in the ANU School of Art, Mr Flynn is well aware of. The difference is that rather than viewing the porous nature of the material as a problem – after all not many people want a pot that won't hold water – his filters capitalise on this property.

Other commercial ceramic filters do exist, but, even if available, with prices starting at US\$5 each, they are often outside the budgets of most people in the developing world.

The filtration process is simple, but effective. The basic principle is that there are passages through the filter that are wide enough for water droplets to pass through, but too narrow for pathogens. Tests with the deadly E-coli bacterium have seen the filters remove 96.4 to 99.8 per cent of the pathogen – well within safe levels.

Using only one filter it takes two hours to filter a litre of water.

The use of organic material, which burns away leaving cavities after firing, helps produce the structure in which pathogens will become trapped. It overcomes the potential problems of finer clays that may not let water through and also means that cracks are soon halted. And like clay and cow dung, it is universally available.

"The developing communities that need most assistance fall between the tropics. Tea, coffee and rice are grown in these areas," explains Mr Flynn.

"Everyone has a right to clean water, these filters have the potential to enable anyone in the world to drink water safely," says Mr Flynn.

Step-by-step guide to making water filters

1		Make the clay mixture.	Dig the red to brown coloured terracotta clay and dry it in the sun. Pound and crush the clay so that it is fine and powder. Mix one handful of dried and crushed clay with one handful of dry organic material (used coffee grounds are ideal, rice hulls or tea leaves may also be used), ensuring it is well distributed through the clay. Add a little water at a time, using just enough to produce a stiff mixture that is firm to handle, is not wet and will not lose its shape when moulded.
2		Shape into filter pots and place them in fire.	Shape the clay mixture into a cylinder and leave it to dry in the sun. The walls of the finished pot should be about as thick as an adult's index finger. Do not break up or crush the lumps of cow manure, the best heat will come from as-found lumps or pats. Put the dried filter forms onto a layer of dry manure, surround them with dry straw or leaves and add another two or three layers of manure. The pots should be completely covered and not visible. Light the straw or leaves.
3		Fuel the fire with more manure.	The fire will reach a temperature of 700C in about half an hour and will reach 900-950C after another 20 to 30 minutes. It will be necessary to add manure – placing it over holes in the sides and top of the burning mound – to keep the fire at the required temperature. The temperature of the fire can be judged by its colour, when it is burning well the fire will be a bright orange-to-yellow colour. The filters should be in the fire at that colour for at least 30 minutes.
4		Bake the filters in the fire.	The firing process will take less than an hour to sinter the filters and burn away the organic material, leaving passages that are wide enough for water to pass through, but too small for contaminants such as e-coli.
5		Remove the filters from the fire.	After firing for 45-60 minutes, remove the pots from the fire. The pots will be red hot so should not be touched. More unfired pots can be put into the fire at this point, and covered with more cow manure as before. You will need to repeat the process and wait until the fire is burning strongly and to see the same colour again for at least 30 minutes before removing the next filter.
6		Filter water.	Allow the filter to cool. Wash out any charcoal or rubbish and fill with water. Discard the first water to pass through the filter, water can then be filtered through them. For heavy contamination, two or more filters can be used in a series.

It is not recommended that water from this filtration process be consumed where clean drinking water is available. The Australian National University accepts no liability or responsibility for any loss or damage suffered as a result of direct or indirect use or application of the filtration process.