Technology developed at UFRGS uses solar power to deliver drinkable water to

Water disinfection prototype utilizing sunlight is highly efficient and has a low-cost structure. The technology was the first green patent from UFRGS to be acknowledged

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The search for an effective and low-cost solution for water supply in the outskirts resulted in UFRGS obtaining its first green patent. The register, obtained in 2020, responds to the request made by a group of scientists from the Post-Graduation Program on Agricole and Environment Microbiology (PPGMAA) responsible for the development of a technology to process the water in continuous flux through solar power, which presents itself as a reasonable and accessible alternative against conventional process methods, and it can also be implemented alongside them.

The already known method is called SODIS (Solar Water Disinfection). Generally, it consists of putting transparent PET bottles (or other types of transparent recipients) with the liquid under the sun for at least six hours to kill microorganisms and make the water drinkable again, thanks to the heat and radiation emitted by the big star. However, the volume of water obtained is very low, requiring a long and exhaustive work – besides, in impoverished regions there is not always so many bottles or recipients available. The additional advantage of the technology developed at UFRGS is that it heats and sterilizes water with solar beams in a constant operating manner, which provides a much higher volume of water than the static SODIS does. The equipment created by the researchers can also be installed on the collecting-site of water without the need of electric energy and at a low cost, besides being highly adaptable both in terms of its dimensions and in its setup.

The patented method is part of the Master's research of Mozambican researcher Beni Chaúque, who is presently improving it in his doctoral studies conducted at the PPGMAA, where the prototype is being developed in partnership with the Hydraulic Project's Laboratory of the Institute of Hydraulic Research (in Portuguese, Instituto de Pesquisas Hidráulicas, IPH) of UFRGS. Chaúque says that he meant to find an alternative solution for potable-water supply to meet the needs of many rural areas. "The conventional large-scale systems, aside from being expensive, are only adequate to places like urban centers, with a high demographic density. Despite the governmental obligation to supply the whole population, less populated areas end up not being cost-effective for the regular proprietary water supply systems," he explains. According to him, the research group searched for an efficient – which provides enough water – and accessible system, and began with the SODIS system, which was known already, and with some portions of the work of his advisor, Marilise Brittes, and his co advisor, Antônio Benetti. "The conventional SODIS is made in a transparent flask, an empty bottle, put under the sun for a period of six hours (or twelve on cloudy days). But how to use the system to supply more people and to have more volume of water? The volume of treated water by unit of time obtained with SODIS is unsatisfactorily reduced," says Chaúque. The objective of the researchers was to design an equipment capable of sterilizing higher volumes of water through SODIS, in a more cost-effective way, without the use of electric energy.

The group investigated other technologies in use for water disinfection. Antônio Benetti informs that, only in Rio Grande do Sul, were found about two thousand small disinfecting systems, including one with a series of bottles exposed to the sunlight. However, explains the Professor, two thirds of these systems proved to be inefficient to keep the water uncontaminated from microbial organisms, due to defective systems and lack of water treatment.

The technology developed at UFRGS revealed to have an effective microbiological control. The researcher Marilise explains that the prototype was tested with several bacteria and protozoan and was able to deactivate even microorganisms resistant to common water disinfecting process, like chlorination. Beni Chaúque clarifies that the system basically works by collecting and directing ultraviolet and infrared radiations from the sun into the water. "Our system captures these radiations and drives them onto the water that flows uninterruptedly through the equipment, reducing the customary six hours of disinfection to minutes or even seconds," he highlights, adding that the system, in experimental scale, reached the disinfection of 1 liter for every ninety seconds. The result is not yet ideal, since, according to co advisor Antônio, each person would need around 25 liters of water a day, while the system proved to have the capacity to deliver 360 liters in one day. Another aspect to be improved is the supply method of the tank, which is manual. But Beni tells in advance that the scientists are presently developing adjustments so the water can be automatically pumped into the equipment propelled by gravitational force or solar energy from photovoltaic panels.

The improved system consists in two tanks, one for heating and one for cooling, plus a tubulation through which the water flows, receiving the solar rays. There is a set of mirrors that redirects these rays to the tubes where the water flows. Since the system is fed in a continuous flux – the water keeps flowing through the tubulations and being sterilized – the water disinfection capacity is enhanced to high volumes. The good results obtained with the prototype motivated the group of researchers to request a patent.

Green Patent

The patent registry was made with the help of the Office of Technological Development (in Portuguese, Secretaria de Desenvolvimento Tecnológico – SEDETEC), UFRGS department responsible for the promotion of innovation and entrepreneurship at the University. According to Felipe Grando Brandão, coordinator to the Intellectual Property Sector of SEDETEC, the patent requests are sent to the National Institute of Industrial Property (in Portuguese, Instituto Nacional da Propriedade Industrial – Inpi), and it may take a long time before the patent is finally issued. However, in the case of green patents, this procedure is shortened: "One of the main advantages of doing a patent request on the Green Patent Program is that this request is given priority. One of the intentions is to issue *[the patent]* as fast as possible so that the bearers may negotiate with the entrepreneurs interested in putting such technology on the market, at the service of people and the environment. The idea is that as soon as we know the patent was granted it will be easier and more interesting to license it, and it will reach users quicker". Felipe additionally explains that another benefit of the green patent is the publicity it receives, indicating the technology contributes for the ecological preservation and the maintenance of the human life on Earth.

For the researchers, the acknowledgment of the patent request does not mean the end of the project. Beni intends to improve it in his doctoral research. Aside from the alternatives in water pumping for the tank, the research group is planning to develop further microbiological tests, with other chemical components, and to build the equipment in real scale.

Translated into English by Marina Benites da Rosa Ibaldo, under the supervision and translation revision of Elizamari R. Becker (PhD) – IL/UFRGS.