Title: Solar-based technologies to provide drinking water in LMIC communities

Abstract: While significant progress has been made in alleviating water scarcity, billions of people still lack access to safe drinking water in low- and middle-income countries (LMICs) located in Asia, South America, and Sub-Saharan Africa, where diarrhoeal disease results in over 485 000 deaths annually. Financial and environmental constraints limit the expansion and implementation of conventional centralised drinking water and sanitation infrastructure in these countries. The use of decentralised household water treatment and storage (HWTS) systems may then serve as a viable strategy to increase access to potable water, as the risks of diarrhoeal disease can be reduced by up to 61 %, provided that the HWT systems are effective, and are used correctly and consistently. These HWTS systems should be environmentally sustainable and cost-effective, removing the need for fossil fuels and reducing the production of harmful or hazardous by-products. The microbial quality of the treated water should also adhere to the World Health Organisation (WHO) water quality standards and produce sufficient volumes of at least 20 L per person per day. Additionally, as HWTS systems are operated and maintained by the households, the systems need to be easy to use, with low maintenance and energy requirements while remaining socially acceptable. While there are several HWTS systems, such as membrane or ceramic filtration, flocculation, and chemical disinfection, that meet the above criteria and are endorsed by the WHO, various factors including the source water type, its associated physic-chemical properties, and microbial pathogen type present, may influence the efficiency of these HWTS systems in LMICs.

'SODIS' is a zero-cost intervention that has been extensively investigated over the past 30 years and recognized by the WHO as a suitable household water treatment and safe storage technique. The main obstacles to widespread SODIS use will be discussed. This paper will review and discuss several engineered solar-based treatment systems that overcome the key drawbacks of existing methods and point at future solar drinking water solutions. Several solar reactors designed, built and tested within specific rural contexts have been shown to effectively treat water regardless of the turbidity or pathogen type detected in the water. Other photo-chemical and photocatalytic approaches to improve the disinfection efficiency will be also explored.

References:

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