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Laurence Mathieu, A Keraval, J.-C Block, Jean-François Mougel, Denis Mathieu, et al.. Assessment of low-power ultrasound device on biofilm formation and carbonate deposition in heat exchanger: a lab study. GRUTTEE, Oct 2017, Strasbourg, France. hal-03749728

HAL Id: hal-03749728

<https://hal.univ-lorraine.fr/hal-03749728>

Submitted on 11 Aug 2022

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Assessment of low-power ultrasound device on biofilm formation and carbonate deposition in heat exchanger: a lab study

L. Mathieu¹, A. Keraval¹, J.-C. Block¹

Jean-François Mougel², Denis Mathieu³, Pierre-Olivier and Julien Jost⁴, Stéfanie Machicado⁵

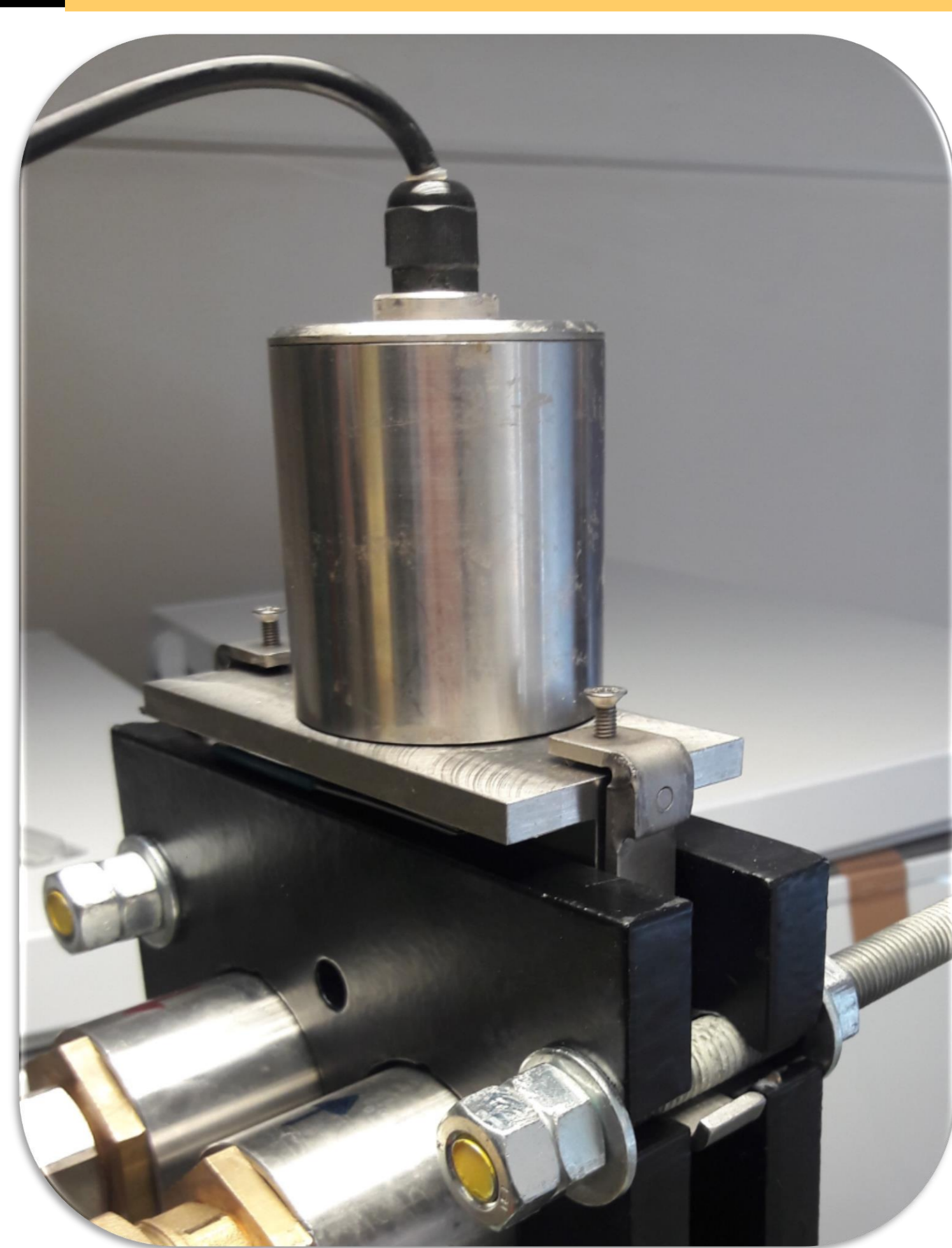
laurence.mathieu@univ-lorraine.fr

Background and objectives

Bio-fouling of any material in contact with water results in a range of adverse issues for industrial engineered water systems such as decrease in water transport efficiency, heat exchange limitation, corrosion, increase maintenance costs, and environmental impact (indeed traditional cleaning strategies used sometimes unfriendly chemicals). Alternative procedures (less drastic, eco-aware, low water footprint, material integrity respect) are required especially for reducing environmental impacts.

Here we assessed the ultrasound efficacy on heat exchangers, which experience problems with biofouling formation (mainly carbonate deposition, biofilm formation, and 'sludge' accumulation).

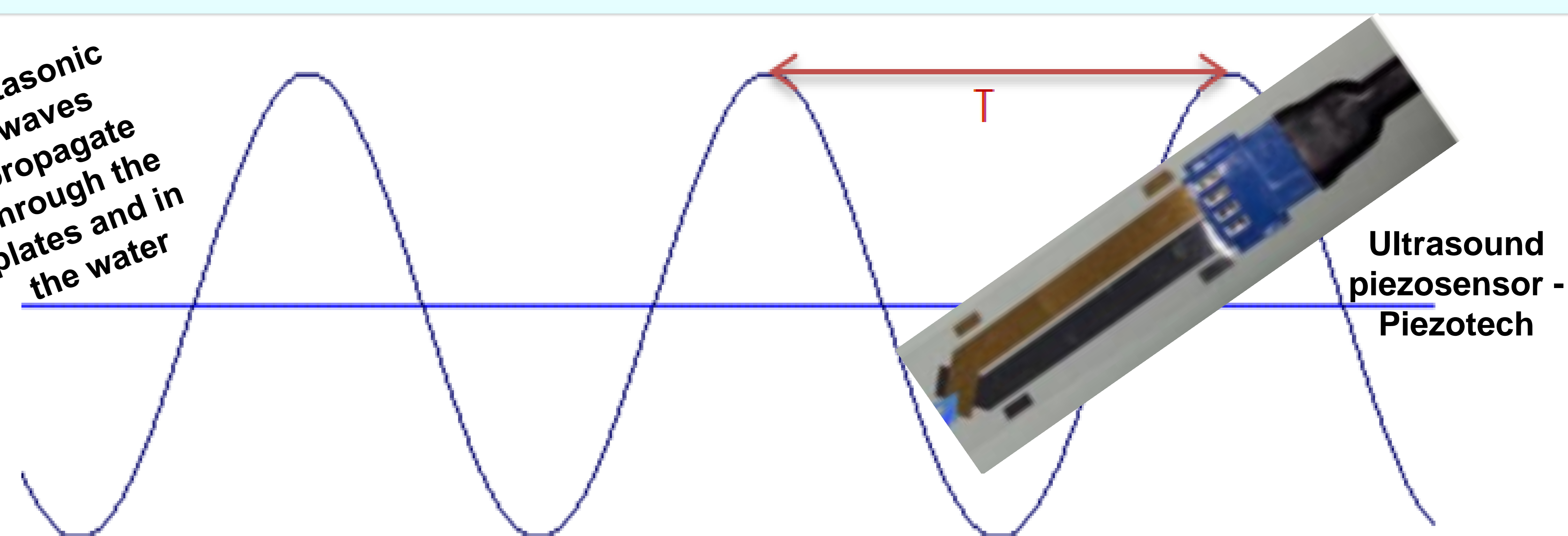
Materials



Ultrasound wave generator Sofchem

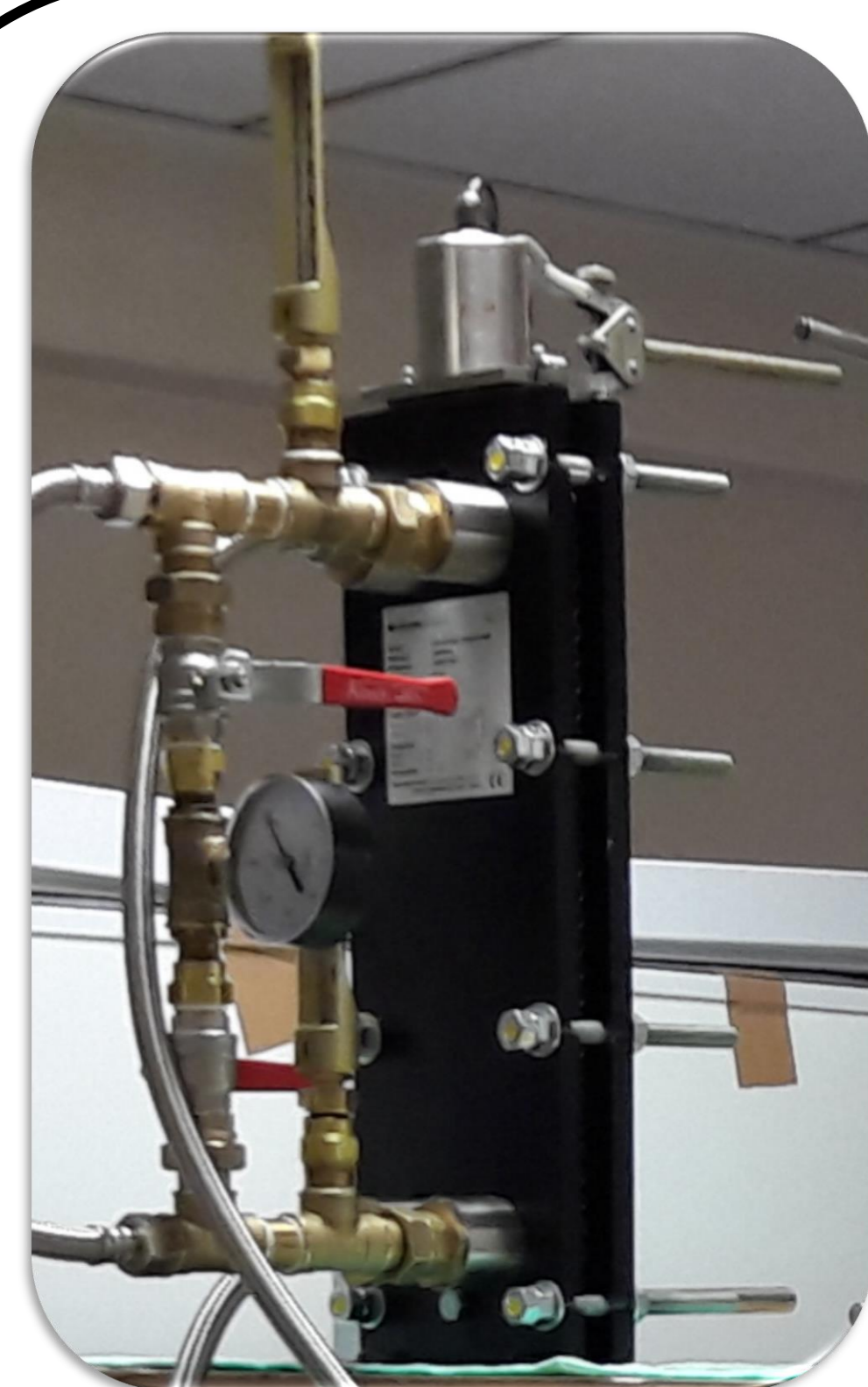
Power of work: 10 W and 25 W

Ultrasonic waves propagate through the plates and in the water



Ultrasound piezosensor - Piezotech

Stainless steel plate (cm)
(length 42; width 12; thickness 0.06)



Heat exchanger Flexiplak GCP-012 (Atlantic)

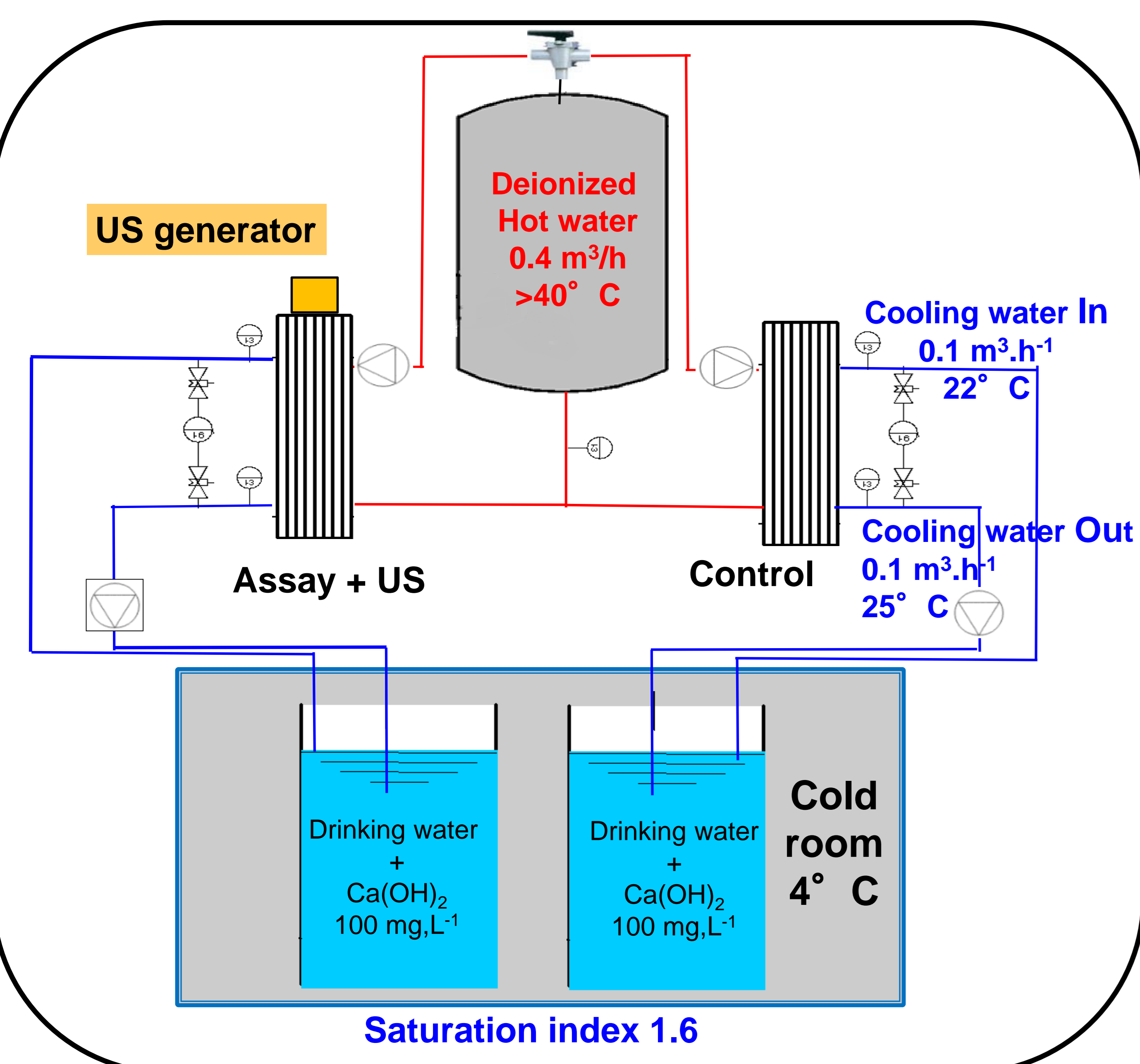
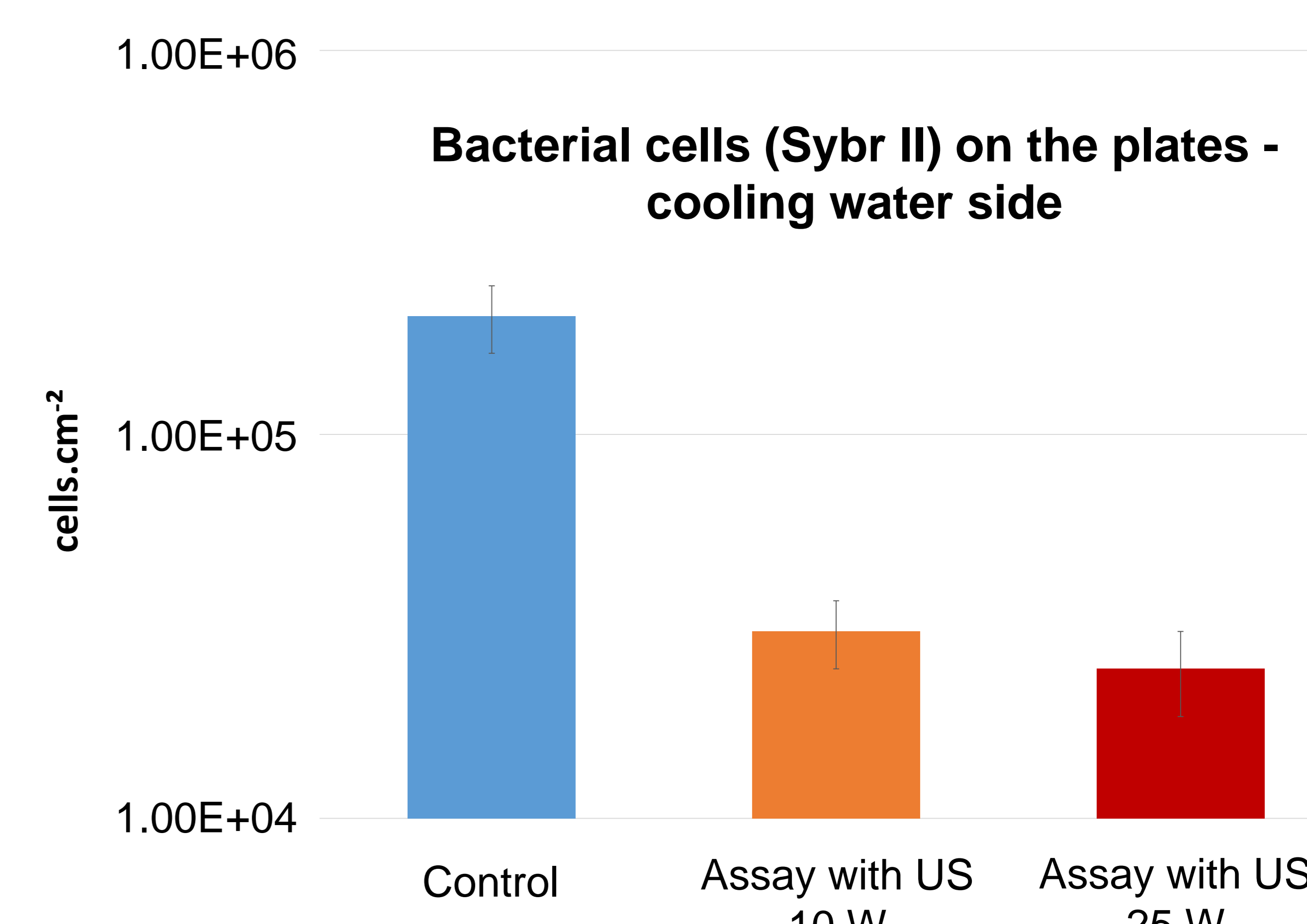
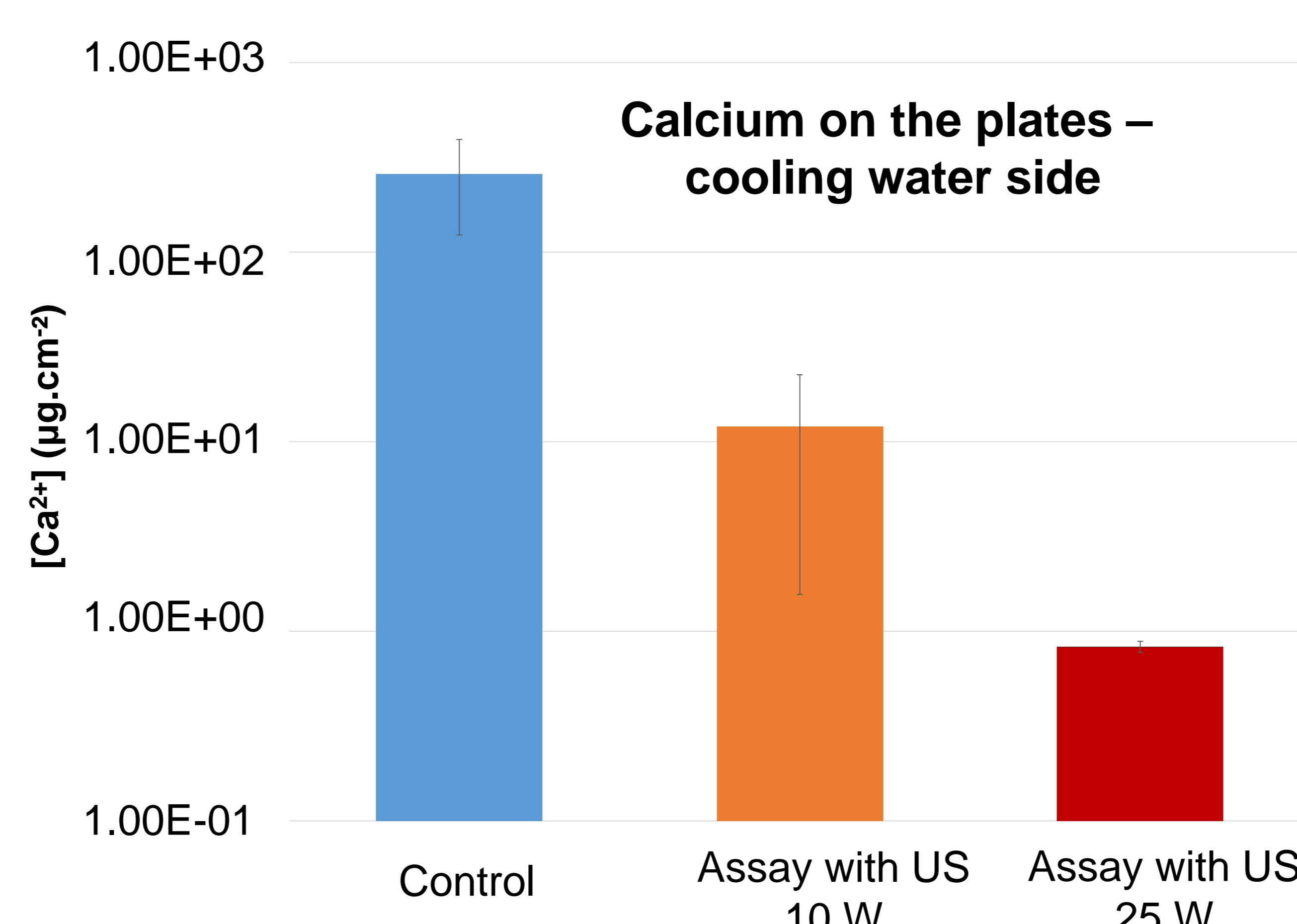
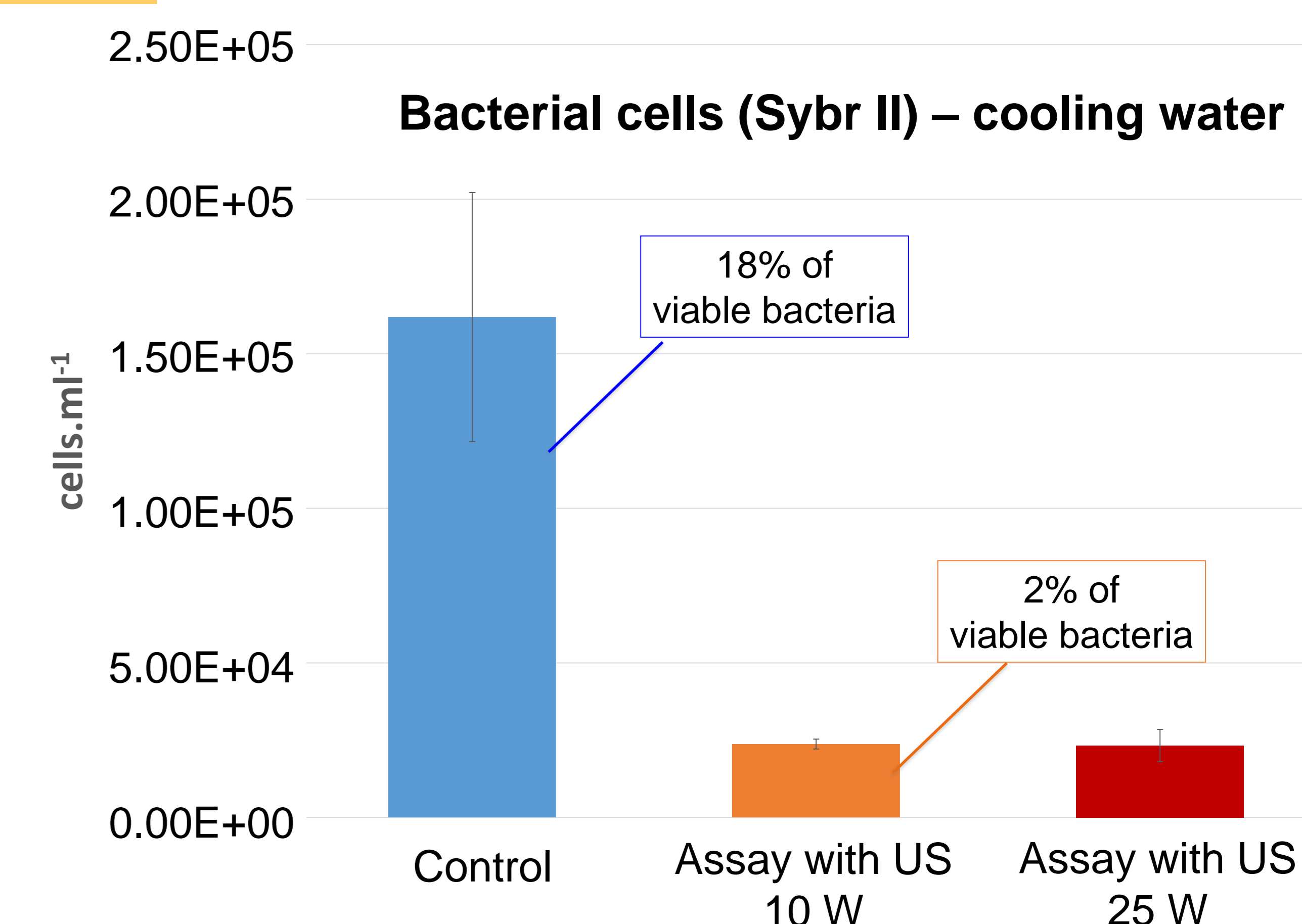
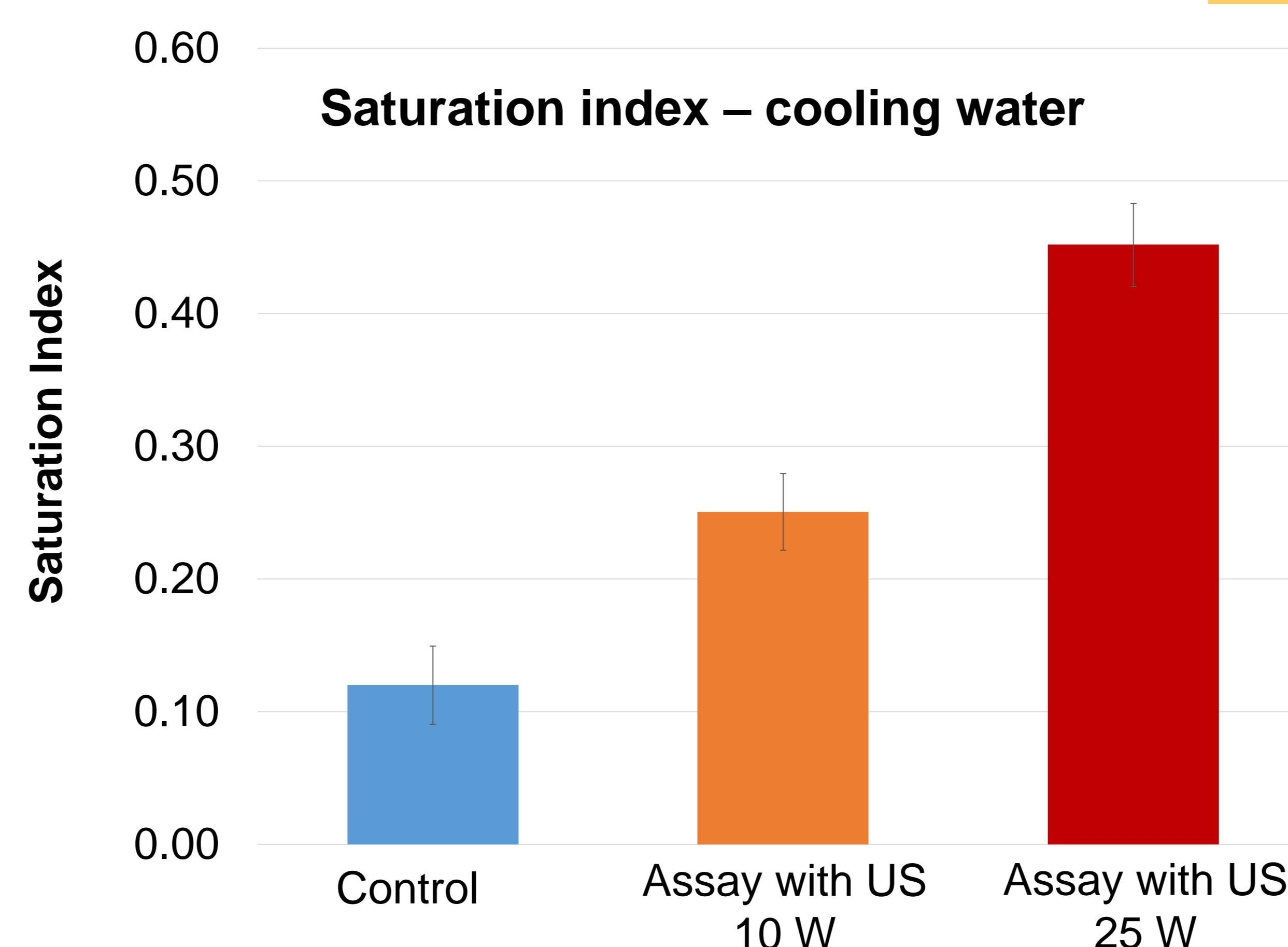


Conclusions

In the heat exchanger submitted to ultrasounds (cooling water side):

- Deposition of calcium carbonates on the plates was decreased by a factor 20 to 300 (according to the power of the ultrasound transducer) comparatively to the control without ultrasounds.
- Biomass on the plates (number of bacterial cells) was decreased by a factor 7 (whatever the power of the ultrasound transducer) comparatively to the control without ultrasounds.

Results



Acknowledgements: This 2016-2017 project funded by the EU (FEDER-FSE Lorraine and Massif des Vosges) and the Région Grand Est was carried out by ¹Laboratoire de Chimie Physique et Microbiologie pour l'Environnement and EPHE, LCPME, UL-CNRS, Villers-les-Nancy, F; ² SO.GE.EAU, Gérardmer, F; ³Ascometal, Hagondange, F; ⁴Sofchem, Rueil-Malmaison, F; ⁵HYDREOS, Tomblaine, F.