31st EFFoST International Conference: Food Science and Technology Challenges for the 21st Century - Research to Progress Society, 13-16 November 2017, Melia Sitges, Spain

# Study about the performance of a novel UV-C reactor design for liquid foods

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Amongst novel non-thermal preservation technologies for liquid foods, UV-C treatment has recently gained significant attention due to the possibility of improving shelf-life with less impact to the nutritional and sensorial properties compared to thermal processing. One of the main challenges for this technology remains a reactor design to effectively inactivate microorganisms. Factors affecting the inactivation are, firstly, the low transmittance of the UV-C energy, especially in turbid and absorptive media, which might reduce the efficiency of the inactivation. Secondly, deviations in the residence time of each particle in the reactor result in variations of the received dose.

In the present work, a new lab-scale UV-C reactor for treating liquids was designed. The reactor comprises six separately-adjustable UV-C sources and a serpentine-shaped tube system manufactured using Fluorinated Ethylene Propylene (FEP).

The performance of the newly developed reactor was compared versus a thin-film laminar reactor. As indicators of the performance, three parameters were measured: chemical actinometry, residence time distribution and biodosimetry using *Escherichia coli* DH5α inoculated in a model solution with 0.06% yellow sunset dye.

The results show that using the newly designed "Serpentine" reactor, complete inactivation of the model microorganism from initial concentrations as high as $10^8$ was successfully achieved at a UV-C dose of 1,348 J/L using all six UV-C sources. Using half of the energy, an inactivation above 5 logarithmic cycles was achieved at a dose of 699 J/L. Measurements of RTD in the newly-developed reactor showed a lower variance in the mean residence time and more similar plug-flow behaviour than the thin-film reactor.

Further studies need to be carried out to tackle the remaining drawbacks, expecting improvements in the efficiency with respect to the results achieved in this study.