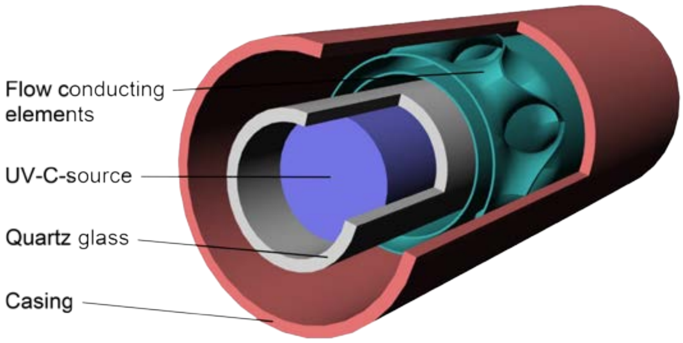
31st EFFoST International Conference: Food Science and Technology Challenges for the 21st Century - Research to Progress Society, 13-16 November 2017, Melia Sitges, Spain

Improving UV-C treatment of liquids in a thin film reactor using flow conducting elements

Gräf, V.[1]; Kromm, L.[1]; Hensel, A.[2]; Hansjosten, E.[2]; Gomez, M.[1]; Stahl, M.[1]; Greiner, R.[1]
[1]Max Rubner-Institut / Department Food Technology and Bioprocess Engineering
[2]Karlsruhe Institute of Technology / Institute for Micro Process Engineering

Ultraviolet (UV) treatment of liquid food is a promising technology to improve food safety. It can be an alternative or supplementation to classical thermal pasteurization. The penetration depth of UV-C energy in liquids with a high optical density is relatively low. To overcome this problem it is possible to use special reactor designs leading to characteristic flow regimes (e.g. thin film reactors, dean vortices or turbulent flows).
In this study, flow conducting elements have been manufactured by selective laser melting technology (SLM) to improve the energy input into a liquid by forming thin liquid layers. SLM is a 3D printing technology which allows to create new constructive designs and to build complex geometries.
We present thin-walled flow conducting elements which allow for a fluid to be divided into separated thin layers. That way, the flows are directed separately and alternatingly to the UV-C source.



Thin film UV-C reactors represent a popular constructive form for the treatment of liquids, enabling energy input into high absorptive media such as liquid food.
To enhance the efficacy of the UV-C treatment, flow conducting elements have been incorporated into a thin film reactor. Chemical actinometry and biodosimetry with an indicator microorganism have been used to evaluate the effect of the flow conducting elements.
Our findings show significant improvement of the thin film reactor UV-C energy transfer using flow conducting elements. This leads to a higher actinometric dose and significantly higher microbial inactivation when the flow conducting elements are used.
The results of our study show the possibility to optimize a thin film reactor by incorporating flow conducting elements to improve the UV-C input into liquids.