Modeling microwave heating in a multimod applicator – Comsol approach

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This study aims to model the microwave (MW) heating in a multimod applicator, using first principle equations. The MWs, of low power, are generated with a solid state generator, at 2.45 GHz. The absorbed power in the liquid phase is under 7W (determined by calorimetric method), suited for studies related to the MW effects upon leaving microorganisms. The influence of the shape of the irradiated volume was investigated, using two glass reactors, with different heights and diameters (small vessel 133 mm x 44 mm with 100 mL liquid, big vessel 130 mm x 69 mm with 200 mL liquid). The liquid phase acts like an electric field concentrator, with different streamlines densities per the liquid volume used. To mimic the mixing of the liquid phase in the two reactors rotated by a plate, an asymmetric U shape agitator was used, with very good mixing results for a rotational speed of 30 rotation / minute. Finally, the model was tested, with very good results, against two experiments where the liquid phase was kept at 35 ºC under MW irradiation and cooling using a thermal agent coming from thermostatic bath - in both cases, a less than 0.6 K gradient of temperature for the whole liquid volume was observed.