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MODELING THE TEMPERATURE FIELD DYNAMICS DURING THE MICROWAVES ASSISTED EXTRACTION OF ACTIVE PRINCIPLES FROM VEGETABLES

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The conventional and microwave solvent extraction of active principles from vegetables is a mature experimental domain. Still, the mathematical modeling of microwaves (MWs) irradiation using either multimode or monomode MWs applicators should be improved. MWs irradiation intensifies extraction process since, due to its higher tangent loss, the vegetable gets preferentially heated. In a recent paper[1], this is explained based upon the chemical potential: for only 1K positive difference in temperatures of the solid and liquid phases, the latter is responsible for osmosis of solvent from the liquid to the solid phase, thus increasing the internal pressure, which disrupts the cell's membrane. Another recent paper[2] emphasizes experimentally that the intensification of the extraction in MWs field has the same causes. Still, there is no direct proof that such a non-uniform heating appears.
We present the modeling, in Comsol Multiphysics®, of a multimode MW applicator in which ethanol/water solution extracts active principles from vegetables. The solid – liquid temperature difference is the result of two dichotomic processes: in solid MWs generated heat and transferred heat to the surrounding liquid. With working temperature increase, the vegetable losses increase, while the solvent's decrease, therefore selective heating will be enhanced at high temperatures.

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