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DIELECTRIC PROPERTIES OF A MULTIPHASE MIXTURE. EFFECT OF TEMPERATURE AND COMPOSITION

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Microwave assisted extraction has been repeatedly claimed as a powerful method for the recovery of valuable components from natural products. However, there is an unmet need of dielectric properties for these complex mixtures, as a function of the main operating variables.

In this work, the complex permittivity of a multiphase mixture has been measured as a function of temperature, solvent composition and solid-liquid ratio. The solvent was a mixture of ethanol and water, and the solid phase was grape pomace. Grape pomace is a valueless residue from winemaking industry, but with a great potential due to its high antioxidant activity.

One *Dielectric Kit for Vials*, developed by the ITACA research institute, was used to obtain the experimental values. These values were later correlated to obtain a mathematical expression of dielectric properties as a function of temperature, solvent composition and solid-liquid ratio. First, ethanol-water mixture permittivity was calculated by a simple square root mixing rule from pure compounds properties. The permittivities of pure components were computed by Debye's Law, with parameters fitted as temperature functions. Ethanol-water mixture permittivities were predicted with a deviation of 9.5%, compared to experimental values.

The dielectric properties of the solvent-solid mixtures were then calculated using different multiphase mixing rules, from solvent and grape marc[1] experimental values. However, results were unsatisfactory. The reason was that conductivity losses caused by ions released to the solvent from the grape marc resulted in a significant increment of the loss factor (9-83%). For this reason, a conductivity losses term was added to the resulting multiphase mixing rule of permittivity. In addition, the traditional power law multiphase mixing rule was also modified to increase solid-liquid composition influence, using one adjustable parameter. In this manner, multiphase dielectric experimental values were reproduced with an 8.1% error, and loss factor values with a 24.8% error.

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References

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