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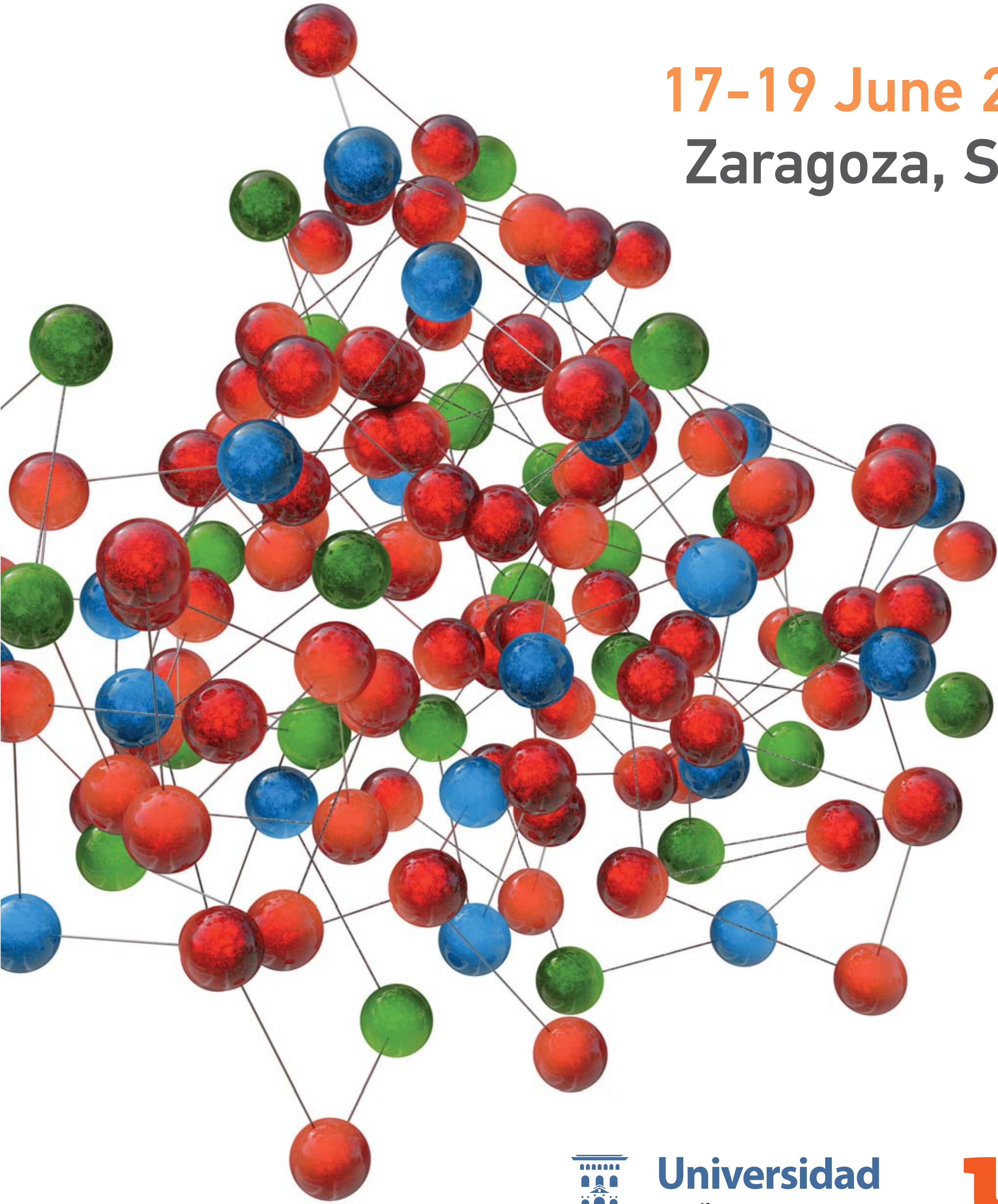

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Book of Abstracts

T4P07 – MIGRATION OF BENZOPHENONE AND 4-METHYLBENZOPHENONE INTO FOOD SIMULANTS: INFLUENCE OF THE PERCENTAGE OF ETHANOL

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- **Introduction**

The last year, 2014, the European authorities have reported only two cases related to the presence of photoinitiators in foodstuffs; nevertheless, in the last ten years more than a hundred cases have been reported (1). The scientific community has worked in this food safety concern in order to deal with this food safety problem; however, the focus has been in the development of analytical methods or in the development of new low-migration photoinitiators (2).

Only a few articles provide information about their mechanisms of migration into the foodstuffs, and even there is less information about their migration kinetics. One of the most exhausting works has been carried out by Sanches-Silva et al. (3); where the migration kinetics from LDPE into food simulants of six photoinitiators: benzophenone, ITX , Quantacure® EHA and Irgacure® 184, 651 and 907 has been studied. In this work, the parameters that might influence the diffusion coefficient (D_e) were evaluated: temperature, photoinitiator molecular weight and food simulant. The study did not found significant variation in this parameter with the food simulant in five of the photoinitiators; however, in the case of ITX, "*the higher is the amount of ethanol in the simulant, the higher is the diffusion coefficient".*

Under this premise, our work has been addressed to study the possible correlation between the percentage of ethanol in the food simulant and the coefficient of diffusion in two photoinitiators: benzophenone (BP) and its derivative 4-methylbenzophenone (4-MBP). To check this hypothesis, migration studies have been carried out in order to obtain the diffusion coefficients.

- **Materials and methods**

The photoinitiators were benzophenone (BP, CAS No.119-61-9) and 4-methylbenzophenone (4-MBP, CAS No. 134-84-9). LDPE was the source selected and each photoinitiator was included in a different LDPE matrix by extrusion. To perform the food simulants, ethanol (absolute for analysis) was diluted in distilled water in different percentages.

Contaminated LDPE films were cut into sheets, weighed and immersed in different tubes with the selected food simulants under controlled time-temperature conditions (4, 20 or 40 ^{o}C). At preset times two samples were removed and an aliquot of the food simulant was injected in an HPLC-DAD system, in order to quantify at 256 nm the photoinitiator released. The method applied was the same used by Lago et al. (4).

The experimental data obtained were exported to Solver function of Microsoft® Excel 2010 software, by nonlinear regression. In this software, it has been applied the mathematical solutions proposed by Crank, based on the Fick's Second Law, to determine the diffusion coefficients (De).

- **Results and Discussion**

The results obtained are exposed in figure 1. As it can be seen, D_e depends on the storage conditions (temperature), and the migrant. The figure 1 also shows an increasing tendency in the D_e values when the percentage of ethanol in the food simulant is increased too, being clearer this relation at higher temperatures. Sanches-Silva et al. propose that this fact "*might happen due to a possible swelling of the polymer in the presence of ethanol in the food simulant*". This fact explains the data obtained; nevertheless, this proposal has not been demonstrated and further studies should be carried out.

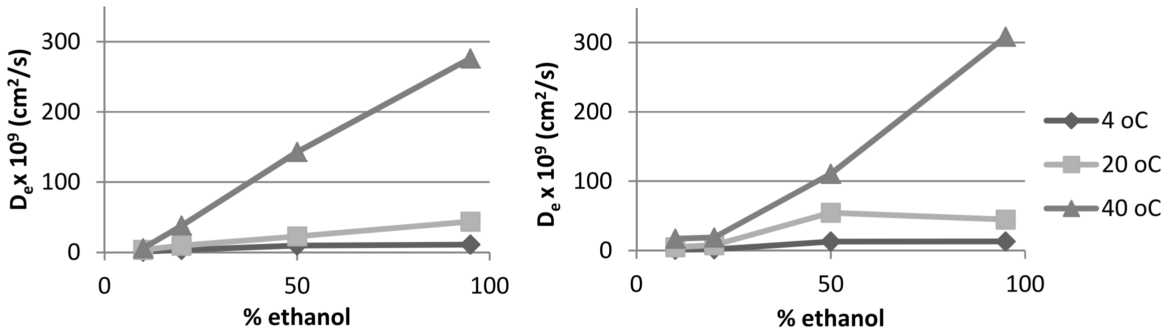

Figure 1 – Relation between BP (left) and 4-MBP (right) D_e values and the percentage of ethanol of the food simulant at different temperatures.

- **Conclusions**

This work provides reliable data of the migration of two common photoinitiators: BP and 4-MPB into foodstuffs. The results confirm that the process of migration is highly dependent on the storage conditions, the photoinitiator properties and the foodstuff (food simulant).

Also this work confirms the theory proposed by Sanches-Silva et al., demonstrating a correlation between D_e and the percentage of ethanol of the food simulant. This correlation could be due to a possible swelling of the polymer; however, further studies are needed to explain the mechanism.

Acknowledgment: The study was financially supported by the "Ministerio de Economía y Competitividad", Ref. No. AGL/2011-26531 "MIGRATIN". Authors are grateful to "Ministerio de Economía y Competitividad" for the Predoctoral fellowship FPI (Ref. BES-2012-051993) awarded to Miguel Ángel Lago. Raquel Sendón is grateful to the "Parga Pondal" program financed by "Consellería de Innovación e Industria, Xunta de Galicia" for her postdoctoral contract.

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