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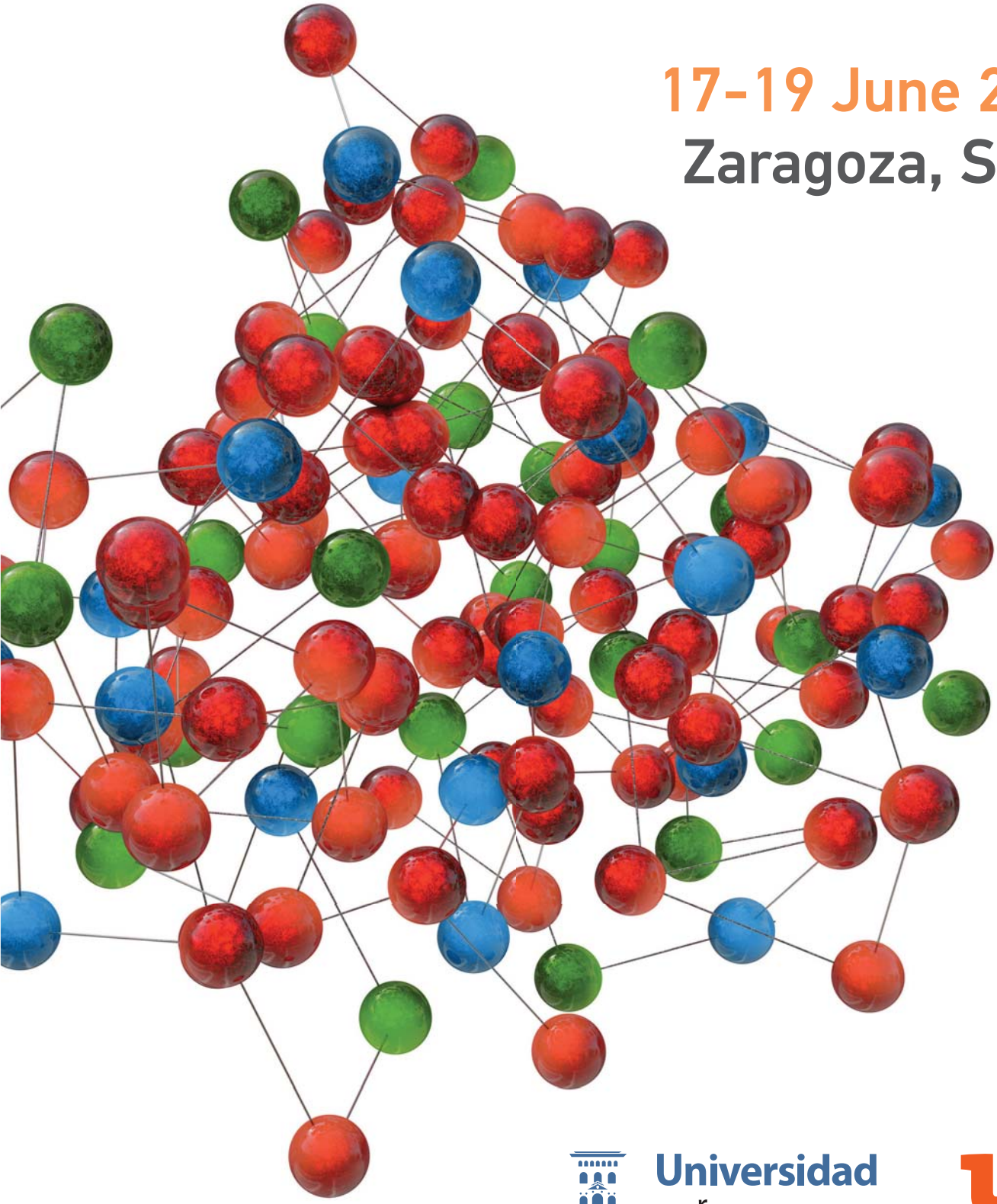

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Book of Abstracts

T4P02 – EFFECT OF PH IN THE MIGRATION OF IRGACURE® 907 INTO FOOD SIMULANTS

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- ## Introduction

The food simulants established by the European Regulation No. 10/2011 to verify the compliance with legal migration limits are six: vegetable oil, MPPO (poly-(2,6-diphenyl-p-phenylene oxide), particle size 60-80 mesh, pore size 200 nm), 3% acetic acid (w/v) and 10, 20 and 50% ethanol (v/v) (1). These food simulants cover all types of food, from hydrophilic foods to fatty, dry or acidic foods (pH < 4.5).

The photoinitiators are one of the components of the UV inks, commonly used in percentages under 15%in their formulations. Nowadays, the UV inks are used in food packaging due to their benefits in compared to the classical solvent-inks (2); for this reason, the possible migration of their components to foodstuffs is a food safety concern and for this reason,it is necessary to carry out studies to evaluate their migration from the packages into foodstuffs.

With this in mind, the migration kinetics of Irgacure® 907 was studied in three food simulants 20 and 50% ethanol (v/v) and 3% acetic acid (w/v) and, in water, in order to evaluate the effect of the pH in the migration process.

- ## Materials and methods

The photoinitiator selected was: 2-Methyl-4'-(methylthio)-2-morpholinopropiophenone (Irgacure® 907, CAS No. 71868-10-5). The food simulants were performed mixing ethanol (absolute for analysis) or acetic acid (glacial) 100% with distilled water. As source, LDPE was selected due to be the polymeric material more used in food packaging.

The experiment was as follows: the Irgacure® 907 was included in a LDPE matrix by extrusion. Each film was immersed in the food simulant, in tubes protected from the light, at different temperatures: 4, 20 and 40 ^{o}C by duplicate. An aliquot of the food simulant was removed from each sample at preset times and they were injected in an HPLC-DAD system, in order to quantify the migrant released at 308 nm. The chromatographic method was the same used by Lago et al. (3).

The data obtained were used to construct the migration curves. The experimental data were exported to Solver function of Microsoft® Excel 2010 software, by nonlinear regression, to apply the mathematical solutions proposed by Crank, based on the Fick's Second Law, and determine one of the key parameters of the migration: the diffusion coefficients (D_e) for Irgacure® 907(4-5),

- ## Results and Discussion

The results obtained in this work are exposed in figure 1. It can be seen that D_e depends on the temperature and the pH of the foodstuff. The D_e values are remarkable higher in 3% acetic acid than in water, obtaining similar values to those obtained with 20% ethanol (v/v) (4 and 20 ^{o}C) or even 50% (v/v) (40 ^{o}C). A possible explanation to this fact could be that, at the pH of acetic acid 3% (w/v) (2.53), the major specie is the protonated Irgacure® 907 and this specie could migrate faster than the non-protonated photoinitiator.

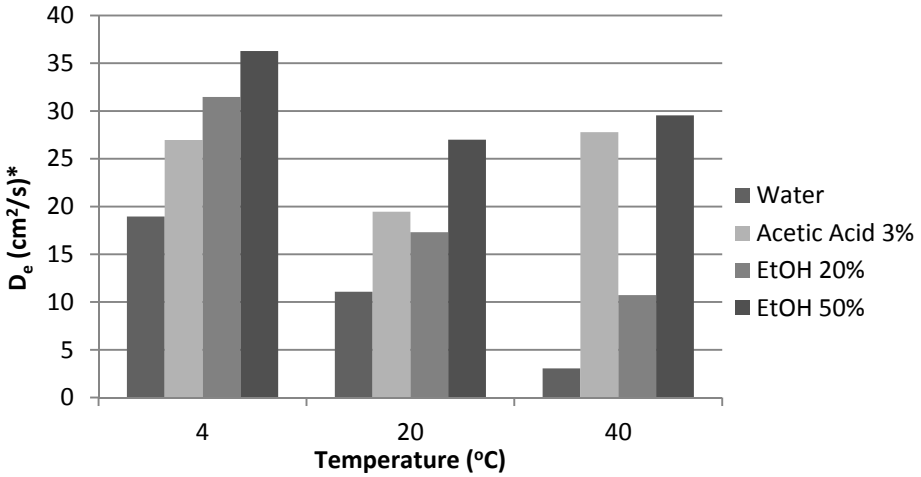

Figure 1 – Irgacure® 907 D_e values at different temperatures in the food simulants. *: the values are multiplied by: 10^{11} at 4 ºC, 10^{10} at 20 ºC and 10^{9} at 40ºC.

- ## Conclusions

This work provides reliable data of the migration of Irgacure® 907, one of the most used photoinitiators in UV inks for food packaging. The results showed that the process of migration is highly dependent on the storage conditions, the photoinitiator properties and even the pH of the foodstuff.

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- ## References

(1) Commission Regulation (EU) No 10/2011 of 14 January 2011 on plastic materials and articles intended to come into contact with food. Off J Eur Union. L12/1.

(2) Lago M.A., Rodriguez-Bernaldo de Quiros A., Sendon R., Bustos J., Nieto M.T. & Paseiro P. 2015. Photointiiators: A food safety review. Food Additives & Contaminants A, 32 (5), 779-798.

(3) Lago M.A., Rodriguez-Bernaldo de Quiros A., Sendon R., Bustos J., Santillana M.I. & Paseiro P. 2014. Simultaneous chromatographic analysis of photoinitiators and amine synergists in food contact materials. Analytical and Bionalytical Chemistry, 406 (17), 4251-4259.

(4) Brandsch, J., Mercea, P., Rüter, M., Tosa, V. & Piringer, O.(2002).Migration modelling as a tool for quality assurance of food packaging, Food Additives & Contaminants, 19(4), 29-41.

(5) Crank, J. The Mathematics of Diffusion, 2nd ed.; Clarendon: Oxford, U.K., 1975.