USING THE IMBIBITION OF ARTIFICIAL GEL-EMULSION SYSTEM AND CUCUMIS SATIVUS L. SEEDS AT SIMULATION OF EARLIER STAGE OF CELLULAR LIFE

CIMPOIAŞU V.M., Maria DINU
University of Craiova, Faculty of Horticulture, Biophysics Department
e-mail: cimpoias@central.ucv.ro

Arctract: *The presence of polyhydroxylated compounds in the prebiotic environment may be an important source for the "RNA World". In our research we use the borate specificity in the formation of the cis-diol complex with a high equilibrium constant with polymer (PAV) and sugars. The time-domain ^{1}H-NMR titration methods are used to monitor the solute concentration by the linear dependence of the "spin-spin" relaxation rate. This technique also permits to establish the specific "spin-spin" relaxation times for the water-polymer compartments, because the difference in the solvation energy induces the different molecular motion (reflected in the "spin-spin" relaxation times of water protons in a fast exchange process). We develop a method for synthesize the gel-emulsion systems capable to generate phase transitions cycles depending on the hydration state (sol-gel and o/w-w/o emulsion) by passing through mesophases. We prove the existence of this intermediary state of this complex system by TEM microscopy on synthetic system in comparison with similar biological gel-emulsion system. We analyze the primary stage of inhibition of lipid rich seeds of Cucumis sativus L. This increasing of the physical capacity for interaction with water by phase transitions and increase the active surface is proved by the increasing of the rate of lipid hydrolyzes in such system.*

MATERIALS AND METHOD

NMR measurements were performed on a 25 MHz pulsed H^1NMR spectrometer using the standard Carr-Purcell-Meiboom-Gill (CPMG) sequence [1] (inter pulse interval 10-3000 s), adapted to distinct among samples. The CPMG T_2 decay was measured by sampling the height of the echoes. The echo decays have been analysed by using at least a non-linear square fit and a Singular Value Decomposition method [2]. Invariably, a multiexponential T_2 decay was observed. Non-linear fitting has been carried out to a maximum of five exponentials. The best solution contains the sum of two or three exponentials with same R-squared value (r^2). All the NMR measurements were carried out at $25^0 \pm 0.1^0$C.

TEM observations. The morphological structure of *Cucumis Sativus* cell was observed with Tesla B-200 transmission electron microscope at 1000-60000 magnifications.

Sample preparation. Synthetic systems. It has been found by several observers that water relaxation time decreased in the presence of macromolecules. We measured the spin-spin relaxation times for the simple synthetic systems: emulsions and gels. Non-linear analyses indicate two or three exponentials with the same r^2. Unfortunately, the value of relaxation time and their populations are not stable and do not have significance because, in this system, probably, the proton state is a continue distribution of relaxation times, consequence of superposition of multiple phases in relaxation.

We analysed the Polyalcohools gel (with polyvinyl alcohol PAV) The transition sol-gel has been realised into a solution of PAV by adding some borate microcrystal.

Sample preparation. Biological systems. The analysed system has been represented by the cell cotyledon of *Cucumis Sativus* seeds during the imbibition process (done into a dark room, at a constant temperature of 27^0 C, on a wet bed of filter paper).

For each biological sample and for each gel system, the water content was determined by weighting the sample before and after drying at 106^0C for 20h [3].

RESULTS AND DISCUSSIONS

We analysed a biological system in interaction with water, represented by the *Cucumis Sativus* seeds, during imbibition process. This system has a dynamical interaction with water and the concentration of water is the most important factor in correlation with the growing of the seeds and with the developing a new plant. This system is interesting because of the internal phases of the seeds during their transformation. Figure 1a,b,c shows the topological distribution during imbibition process.

This system begins with o/w emulsion, passing through mesophase and after that into a complex phase represented by the mixing of gels and w/o emulsion. The decreasing behaviour of pondered spin-spin relaxation time is correlated with the passing through mesophase and coincides with the beginning of a lipid metabolism (Figure 2b,c) .

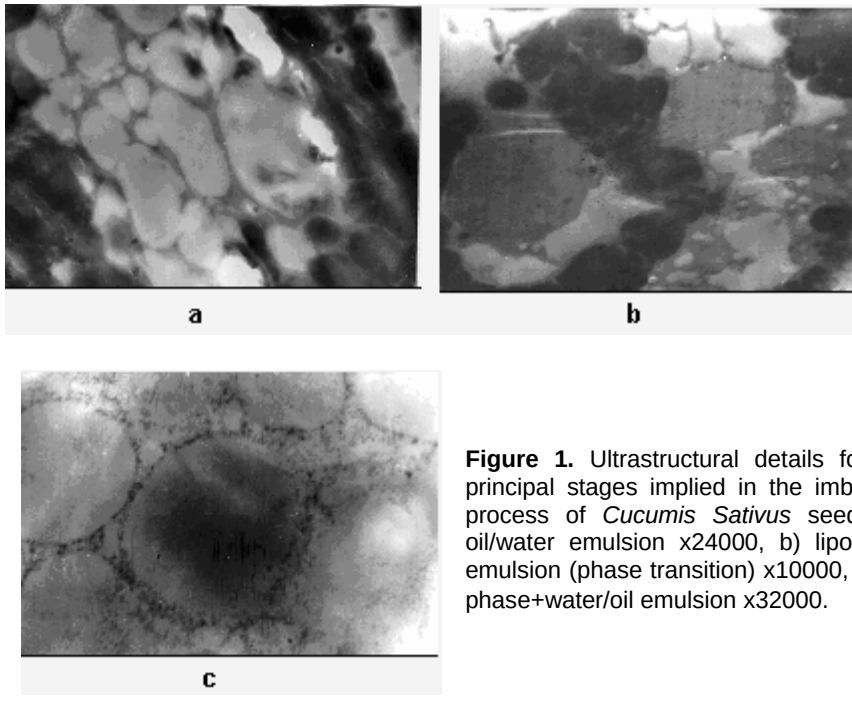

Figure 1. Ultrastructural details for the principal stages implied in the imbibition process of *Cucumis Sativus* seeds. a) oil/water emulsion x24000, b) lipoic gel emulsion (phase transition) x10000, c) gel phase+water/oil emulsion x32000.

The behaviour indicated a special domain named by us "mesophase domain" (MD) which is traversed by the system during the process. The explanation of this behaviour is probably that the system, in interaction with water and with the perturbation element, bears a change in the internal structure, which brings about a decrease of the T_2 when the normal behaviour is increased. Figure 3a,b,c and Figure 2a shows how system sol-PAV passes into gel-PAV depending on the water concentration.

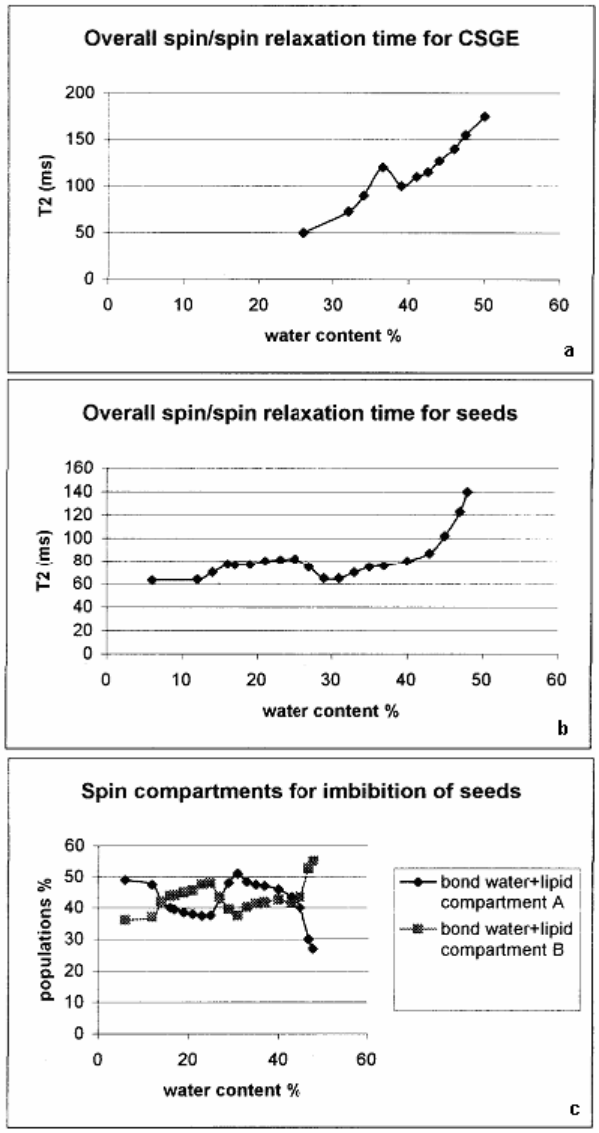

Figure 2. Spin-spin relaxation time T2 for; a) conjugate system gel-emulsion CSGE, b) germinating seeds and c) Evolution of amounts of spin in relaxation compartment; function of water contents.

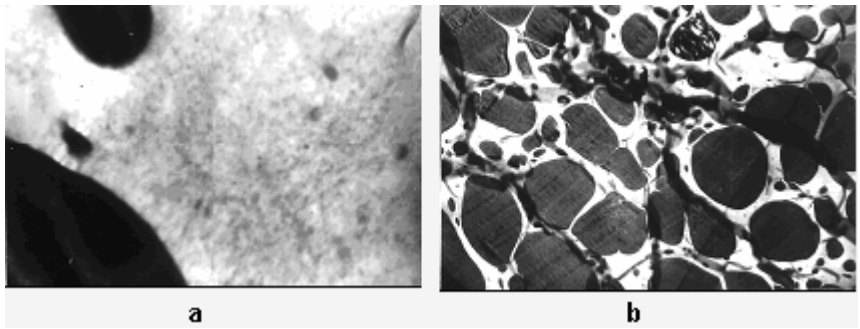

Figure 3. Ultrastructural details for the principal stages implied in the imbibition process of CSGE. a) oil/water emulsion x18000, b) lipoic gel emulsion (phase transition) x1500, c) gel phase+water/oil emulsion x18000.

CONCLUSIONS

The conjugation of gel and emulsion generate phase transitions cycles by passing through mesophases.

The prebiotic physical evolution is performed by increasing the system capacity to interact with water and by phase transitions.

Boron presence in the prebiotic physic system characterized by high contents of polyhydroxylated compounds increases the interaction capacity inside and outside of system.

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