

## Poster 47 Evaluation of process conditions in the bigels production: a multivariate analysis

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Bigels are complex biphasic gels, composed by the mixture of organogel and hydrogel. These systems have been exploited mainly due to their ability to act as vehicle for hydrophilic and lipophilic simultaneously, being very attractive for food, pharmaceutical and cosmetic applications. However, despite the increasing number of publications concerning the production and use of bigels in recent years, to our knowledge there are no papers evaluating the effects of process conditions on their properties. Thus, the aim of this work was evaluating the influence of the process variables on particle size, mechanical and rheological properties through multivariate analysis. For this purpose, organogelator and hydrocolloid concentration, organogel:hydrogel ratio and mixing speed were evaluated. At first, gellan gum hydrogels (1 % - 1,5 % w/w) and glycerol monostearate and high oleic sunflower oil organogels (5 % – 15 % w/w) were produced separately by solubilization at 80 °C during 30 min. After gelation, they were mixed in a mechanical stirrer at determined speed for 10 min. Bigels produced were evaluated through microscopy, rheological (frequency sweeps) and mechanical properties (spreadability, consistency, adhesiveness and cohesiveness). According to principal component analysis (PCA), the reduction of the analysis to a bivariate dimension was satisfactory. The first component (horizontal axis) explained almost 58 % and the second (vertical axis) 20 % of the variability found in measured data. From the projection of variables, it was possible to confirm that consistency and spreadability of bigels are well correlated. These variable were mainly responsible for the variability of data along the horizontal axis as well as complex modulus ( $G^*$ ) that was positively correlated to them. On the other hand, tan delta ( $G''/G'$ ) and adhesiveness were negatively correlated with these variables. The second component was explained mainly by cohesiveness and particle size distribution that were oppositely correlated. These correlations were in agreement with structural arrangement of the bigels. In general, small particle size led to more cohesive systems, with higher viscous modulus (higher tan delta values) and consequently adhesiveness. On the other hand, higher complex modulus is related to stronger structures, which means higher consistency and spreadability. From the cases and variable overlapping it was possible to evaluate that the main variables were mixing speed and organogel:hydrogel ratio. Moreover, different groups were distinguished according to organogel:hydrogel ratio. However, it can be observed that there were synergistic effects among the other variables, which also influenced the physicochemical properties of the bigels and were responsible for the other 20% of variability. Thus, different physicochemical properties can be obtained by tuning the parameters involved in the bigels production process. Softer or harder gels, with higher or lower spreadability, bigger or smaller particles size distribution can be produced depending on the desired final product and application.