DOI: 10.14232/syrptbrs.2022.48

An investigation into relationship between thin films mechanical and rheological properties

Erna Turković, Jelena Parojčić

University of Belgrade, Faculty of Pharmacy, Department of Pharmaceutical Technology and Cosmetology, Belgrade, Serbia

Thin films, as polymers-based flexible dosage forms, are versatile platform for drug delivery. Good mechanical properties are prerequisite and therefore must be assessed to ensure targeted film performance. The following work aims to explore the relationship between common mechanical properties and thin film characteristics obtained by oscillatory rheometry.

Thin films were prepared by solvent casting, using different polymers (hypromellose-HPMC, poly(ethylene-oxide)-PEO, sodium-carboxymethyl cellulose-CMC, polyethylene glycol–polyvinylalcohol-graft-copolymer-KIR, sodium-alginate-SA). Young's modulus (YM), as common mechanical parameter, reflects thin films stiffness, and is calculated as the slope of the stress strain curve, obtained using Z-LX Table-Top Testing Machine (Shimadzu, Japan). Viscoelasticity of the investigated samples was evaluated based on the complex modulus (G*) values, determined by oscillatory rheometry (RheometerRheolab MC 120, PaarPhysica, Germany).

Cluster analysis performed indicated that thin films containing same film-forming polymer were clustered together, with the exception of KIR. This indicates that polymer type is prevailing factor affecting film stiffness and resistance to deformation. High level of correlation was revealed within each cluster group, as higher YM values were accompanied with higher G*. Both YM and G* values for KIR-based films showed high variability, ranging from 51 to 281 MPa for YM and 2 to 50 MPa for G*, indicating that other factors, apart from polymer type are interfering.

The obtained results indicate that it is possible to predict trend in YM based on G* values within the cluster of samples prepared from the same polymer. G* parameter is not extensively explored and provides possibility to further explain film inner structure.

Acknowledgements

This research was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia (project 451-03-9/2021-14/200161).