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Characterization of Poloxamer-based drug delivery systems using Small Angle Neutron Scattering

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Poloxamer-based drug delivery systems are widely used in the pharmaceutical industry. The structural characterization of these systems is crucial for the development of new drug delivery systems and for the optimization of their properties. In this study, we used small-angle neutron scattering (SANS) to investigate the structure of poloxamer-based drug delivery systems. The samples were measured using the VSANS-V16 instrument at the Helmholtz-Zentrum-Berlin (HZB), Germany. The samples contained 20% poloxomer (PL407) and between 0.1% and 1% of the drugs (Nystatin, Prednosolone, Resveratrol, Doxycycline, Rambutan, Mangustan, Diclofenac, Ketoprofen, Ibuprofen, Paracetamol, Ethanol), in deuterated water (D2O). The samples varied in terms of drug quantity and temperature (25ºC, common storage temperature; 37ºC, human body temperature; 40ºC, the temperature of an individual with fever). The analysis of the systems consists of modeling the data using a Python program. The intensity as a function of the scattering vector, which is a sum composed of the form factor, interparticle structure factor, and the micelles polydispersity can be described within the local monodisperse approximation regime. However, the existence of a cubic macrostructure due to the high concentration of the samples was observed, resulting in the creation of a model that took the cubic structure into account. This allows us to obtain important information about the system, such as the radius of gyration, average radius, aggregation number, and total excess scattering density of a chain in the core and corona. In addition to the SANS data analysis, a sample holder was designed and built for small-angle X-ray scattering (SAXS) in order to study and complement these poloxamer-based drug delivery systems to enrich the characterization of these systems. Currently, the SAXS equipment is being built at Laboratório de Ótica de raios X e Instrumentação (LORXI) at the Federal University of Paraná (UFPR). The results will contribute to the development and optimization of new drug delivery systems that are more effective and safer for medical application.