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# Polymerization kinetics of a mixture of Lipiodol and Glubran 2 cyanoacrylate glue upon contact with a proteinaceous solution

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## Abstract

The Glubran 2 cyanoacrylate glue is a liquid embolic agent used to block blood vessels endovascularly. Typically mixed with an iodized oil (Lipiodol) for visualization under X-ray, it polymerizes when in contact with blood and tissues owing to the presence of ions and proteins. The objective of the study is to determine the influence of plasma proteins in the polymerization reaction. A triggering solution containing bovine serum albumin (BSA) and the main blood ions is used as a model of plasma. The polymerization kinetics of Glubran 2-Lipiodol mixtures is measured upon aspiration in a capillary tube and contact with the proteinaceous solution. Having varied the glue and protein concentrations, we show that glue-Lipiodol mixtures with concentrations larger or equal to 25% polymerize when put in contact with an ionic solution containing at least 4% of BSA. The reaction is decomposed into two phases: a fast zwitterionic polymerization induced by the BSA molecules followed by a slower polymerization phase. The reaction speed and extend of the solidification region mostly depend on the glue concentration. The time for the glue solution to polymerize over a 1 mm thickness varies from 5 s for pure glue to about 1 min for a 50% glue concentration, and 10 min for a 25% glue mixture. It is the first time that the kinetics of the two polymerization reactions is quantified for Glubran 2, which will provide the information needed by interventional radiologists to optimize the planning of

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