

Antiviral activity of clays in epoxy composites: a new tool against healthcare associated infections

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Introduction. Inanimate surfaces play a crucial role in the transmission of nosocomial pathogens with particular attention to High Touch Surfaces, (HTSs). To prevent the microbiological contamination of HTSs different technologies have been developed as alternatives to conventional cleaning. More recently, self-disinfecting surfaces with incorporated antimicrobial substances have been proposed. Epoxy resins have long been recognized as versatile materials with widespread applications due to their exceptional mechanical properties, ease of processing and tunable chemical properties that make them particularly suitable for preparing composites exhibiting improved characteristics, such as antimicrobial activity by integration with antimicrobial functionalities. Modified clays have been also considered.

Materials and methods. A commercial epoxy resin, MGS/RIMH235, which we had previously demonstrated having antiviral activity, was used to prepare nanocomposites by addition of different amounts of Cloisite 15A(C15A), an organo-modified clay with an ammonium salt bearing different aliphatic chains to promote compatibilization between the polymer and the clay. Preliminary results showed that composites based on this resin and different percentage (5%, 8% and 10%) of C15A demonstrated a significant antiviral activity using two experimental protocols: a) the virus suspensions were put in contact with the resins for different exposition times; b) they were exposed to buffer solutions in which the resins had been previously incubated for 24h. In both cases, at the end of the incubation time, the residual infectious titre was determined by end point titration. **Results.** Against Human Coronavirus OC-43, a virus infectivity reduction (>4 Log) was observed with composites containing 5% of C15A at 24h with both protocols; a modest antiviral effect (about 1 Log) was also observed for the nanocomposites with 1 and 3% of C15A. All the nanocomposites proved to be more active on HCoV-OC43 than the resin as it is. Under the same experimental conditions Herpes Simplex Virus-1 showed a lower sensitivity (approximately 2 Log reduction) and only for nanocomposite with 5% of C15A. It is to note that, with HSV-1, differently from what was observed with HCoV-OC43, the resin itself showed a more marked antiviral activity compared to the nanocomposite. Finally, no significant reduction of Adenovirus-5 infectivity was observed in any condition tested.

Discussion and conclusions. Epoxin resin based nanocomposites including clays may represent a useful tool in the fight against healthcare associated infections. These modified resins could be used to manufacture tools or surfaces with self-disinfecting properties in clinical settings.