ELECTROPHORETIC DEPOSITION OF CELLULOSE NANOFIBERS IN AQUEOUS SUSPENSIONS

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Cellulose is one of the most abundant organic polymers in nature and a promising biomass. Since cellulose nanofibers (CNF) have attractive features such as a low thermal expansion coefficient, a high elastic modulus, high mechanical strength, and high eco-friendliness, CNFs are envisaged to be applied for biomaterials, tissue engineering scaffolds, filtration media, and reinforcement in nanocomposites. In this study, in order to develop a coating technology with nanofibers for biomedical applications, CNFs in aqueous suspensions were deposited on titanium and aluminum substrates by an electrophoretic deposition (EPD) technique. CNFs used were obtained from Sugino Machine Ltd. (Japan). Aqueous suspensions of the CNFs were prepared using a wet pulverizing and dispersing device. The obtained 0.2wt% aqueous suspensions of the CNFs were stable and not observed the aggregation of the nanofibers. EPD was conducted in a two-electrode system, where titanium or aluminum sheets were used as anode and a platinum sheet as cathode. The constant voltages of 10-30 V were applied to the system for 10-60 seconds. After the process, it was observed that the CNFs were successfully deposited on the anodes. The deposition amount of CNFs on either anode increased linearly with an increase of the applied time at the constant voltage of 20 V. Moreover, the amount also increased as a function of the applied voltages between 10 to 30 V at the constant applied time of 30 seconds. These results indicated that negatively charged CNFs in the aqueous suspension moved to the anodes by the electrophoresis. The adhesiveness of the deposited CNFs was superior on the aluminum anode compared with the titanium anode, indicating that the interaction between them depended on the kind of metal. In conclusion, EPD of the CNFs paves the way for the development of a coating technology with nanofibers for biomedical applications.