

Study of Al hydroxide-polyphenol nanoparticles using the CIE colorimetric system

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Color is a sensory perception which is triggered in humans by the electromagnetic radiation of visible spectrum ($\lambda = 380\text{-}780\text{ nm}$). However, it is dependent on the light of the object, the bidirectional reflectance of the object and the color perception of the observer. The CIE colorimetric system is based on the primary colors R, G, B, the imaginary primaries X, Y, Z and the presence of a standard observer. In this system, the CIE chromaticity diagram is a unit plane within the three-dimensional additive color space of X, Y, Z. Concerning the tristimulus values X, Y, Z, the value Y is denoted as the luminance factor which is identical with the luminous reflectance R. In order to specify the chromaticity in the diagram, the chromaticity coordinates $x = X/(X+Y+Z)$, $y = Y/(X+Y+Z)$, $z = Z/(X+Y+Z) = 1-(x+y)$ are used. These colorimetric concepts were identified by using the method of VNIR spectroradiometry and the software Refcolor. Model substances were chosen by using organomineral complexes which belong to the system of Al hydroxide-polyphenol that were synthesized by adsorption in a gas-solid phase at $50\text{ }^{\circ}\text{C}$ in the presence of atmospheric pressure for two different periods of 7 and 60 days in total darkness. Gibbsite, boehmite and pseudoboehmite, and four types of phenolic compound being pyrocatechol, resorcinol, pyrogallol and guaiacol were used. Following the short- and long-term experiments, it was established that the CIE coloring of the complexes resulted in distinct differences of the color terms: hue, saturation, brightness and lightness. These terms provided a basis for the phenomenological characterization of the complexation. The CIE Y was of particular relevance to this method. This value was observed at 100 % when using pure white Al hydroxides. The CIE Y decreased as the organic coatings increased with the result that the catalysis and the growth of nanoparticles could be characterized. It was clear that the CIE Y was influenced by the nature of nanoparticles in which the ligand type and stereochemical effects were of significant relevance.

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