PÔSTER - RESUMO - MATERIAIS E BIOMATERIAIS

AUNP STABILIZED BY TEMPO-CELLULOSE, IMPROVED REDISPERSION AND COLLOIDAL STABILITY VIA MILD ALKALINE WASHING

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Gold nanoparticles (AuNPs) stabilized with TEMPO-oxidized cellulose (AuNP-TEMPO) are promising because they combine the plasmonic response of gold with the colloidal stabilization ability of a renewable biopolymer rich in carboxyl groups. In this work, we synthesized AuNP-TEMPO using an aqueous route and investigated how a mild alkaline washing step influences redispersion, colloidal stability, and the optical properties of the system. The synthesis was performed from an aqueous TEMPO-cellulose solution under stirring and reflux until boiling. Next, HAuCl4 was added and the system was kept under reflux for 15 min. After this period, an acetic acid solution was added, and the appearance of a terracotta color indicated the formation of colloidal AuNPs. Purification involved three washing cycles with water, followed by centrifugation at 10,000 rpm for 10 min in each cycle, and then five washing cycles with NaOH, also with centrifugation at 10,000 rpm for 10 min. Finally, the nanoparticles were redispersed in deionized water using probe sonication. A visual comparison of the suspensions revealed clear differences in colloidal behavior. Before alkaline washing, sedimentation and heterogeneity were

observed, with aggregates deposited at the bottom, indicating limited stability. After NaOH washing, the sample showed a homogeneous, translucent appearance with no visible sedimentation, suggesting more efficient redispersion and improved stability in water. FTIR results support this behavior by indicating changes in the ionization state of carboxyl groups. TEMPO-cellulose exhibited a band around 1730 cm?¹ associated with non-ionized carboxylic groups. In AuNP-TEMPO before alkaline washing, this band decreased and the band near 1600 cm?¹ increased, indicating a higher contribution of carboxylates. After NaOH washing, the 1730 cm?¹ band disappeared and the carboxylate band intensified, consistent with deprotonation and increased negative charge, which promotes electrostatic repulsion and steric stabilization of the nanoparticles. UV-Vis spectroscopy showed a surface plasmon resonance band around 570 nm in both conditions, confirming AuNP formation. A bathochromic shift of approximately 10 nm was observed after alkaline washing, consistent with changes in the dielectric environment and surface chemistry, with no evidence of aggregation, in agreement with the preserved color typical of stable colloids. SEM images revealed predominantly spherical particles (approximately 20 to 80 nm), with occasional anisotropic morphologies, and a well-dispersed distribution, suggesting effective stabilization by the cellulose matrix. Overall, mild alkaline washing is a simple and effective strategy to improve the redispersion and colloidal stability of AuNP-TEMPO, while also modulating its optical response through surface changes. Acknowledgements: This work was supported by INEO, FAPESP (process no. 2025/27044-5), and CNPq (process 408449/2024-1).

Palavras-chave: gold nanoparticles; tempo-oxidized cellulose; colloidal stability.