Green Synthesis of Gold nanoparticles with Starch-glucose and Application in Bioelectrochemistry

A method for gold nanoparticle (AuNP) synthesis from buffered glucose and starch solution has been developed and the particles investigated by UV-Vis spectroscopy, transmission electron microscopy (TEM), atomic force microscopy (AFM) and electrochemistry. The synthesis proceeds smoothly in neutral and basic solution. The starch concentration, temperature and chemical nature of the buffers are key factors in the AuNP formation. Glucose and starch are reducing and protecting agents, respectively. Among several inorganic and biological Good's buffers, phosphate and MES buffers give the best results with quite uniform AuNPs. Other buffers do not result in well-defined nanoparticle structures. Typical AuNP diameters from MES and phosphate buffers (PB) are 4 ± 1 nm and 13 ± 2 nm with plasmon band peaks at 521 nm and 523 nm, respectively. The role of the phosphate buffer is mainly to control the pH, while MES is also a synergist with more composite function. AuNPs prepared by this method are stable in solution even after 17 months at room temperature. TEM confirms the crystalline structure of the AuNPs, meaning that the AuNP surfaces are low-index single-crystal facets such as (100), (110) and (111). Electrochemistry of the buffers at such single-crystal gold electrode surfaces has offered a more detailed understanding of the buffer effect. The AuNPs have been successfully used in bioelectrochemistry, and found to efficiently enhance interfacial electrochemical electron transfer of the metalloprotein yeast cytochrome c in homogeneous solution. The synthesis has been extended successfully to direct use of starch-rich foods such as potato, carrot and onion to synthesize AuNPs. The present work thus offers a gentle and non-toxic procedure for the synthesis of monodisperse AuNPs in neutral medium with promising potential for pH sensitive biological or medically related applications.

General information
State: Published
Organisations: Department of Chemistry, NanoChemistry, Technical University of Denmark
Contributors: Engelbrekt, C., Sørensen, K. H., Zhang, J., Welinder, A. C., Jensen, P. S., Ulstrup, J.
Pages: 7839-7847
Publication date: 2009
Peer-reviewed: Yes

Publication information
Journal: Journal of Materials Chemistry
Volume: 19
Issue number: 42
ISSN (Print): 0959-9428
Ratings:
Web of Science (2017): Indexed yes
BFI (2015): BFI-level 2
BFI (2014): BFI-level 2
BFI (2013): BFI-level 2
Web of Science (2013): Impact factor 6.626
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Web of Science (2011): Impact factor 5.968
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Web of Science (2010): Impact factor 5.101
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Web of Science (2008): Indexed yes
Web of Science (2007): Indexed yes
Web of Science (2006): Indexed yes
Web of Science (2005): Indexed yes