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Investigation of the Effects of Different Experimental Conditions on the Final Product of a Chemical Reduction Method Used to Fabricate Silver Nanoparticles

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Abstract: Metallic nanoparticles are a focus of interest for a diversity of scientific fields such as medical, engineering and agricultural fields. For such fields, metallic nanoparticles with controlled sizes are pursued for proper utilization in their prospect applications like radiation detection and drug delivery. In this paper, a parametric study was carried out to investigate the effect of different experimental conditions on the size distribution of metallic nanoparticles fabricated by a chemical reduction method. The study entailed modification of four experimental conditions: concentration of the metal precursor ($AgNO_3$), concentration of the reducing agent ($NaBH_4$), dropping rate of the reducing agent to the precursor solution and reaction temperature. A noticeable increase in the average size was observed with increasing the concentration of the reducing agent, decreasing the dropping rate and increasing the reaction temperature. Other changes were found to have negligible effects. Decreasing both the reaction temperature and the concentration of the reducing agent and increasing the dropping rate led to enhanced monodispersity of the size distribution. Changing the concentration of the metal precursor, on the other hand, had a negligible effect of dispersity. Finally, more particle aggregation was observed for both slow dropping rates and high reaction temperatures.