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## Investigation on the Factors Determining the Size Distribution of Gold Nanoparticles in the Citrate Reduction Method

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Controlling the size distribution of gold nanoparticles (NPs) is of great importance due to the fact that their properties are strongly dependent upon the size distribution as well as the size itself. In the citrate reduction method for gold NP synthesis, the citrate works as (1) a reducing agent, (2) a surfactant, and also (3) a weak base: it raises the pH of the whole reaction mixture. Here, we have extensively studied the all three roles of the citrate, by adding other reagents separately (NaBH<sub>4</sub>, CTAB, and NaOH) for the independent control of the three roles of the citrate. Among the roles of the citrate, that as a weak base was found to be the most critical parameter affecting the size distribution of gold NPs and the size distribution became much more improved with the increase of the solution pH, while adding a supplementary surfactant or reducing agent resulted in the formation of less homogeneous NPs.

**Keywords:** Gold nanoparticle, Citrate reduction, Size distribution