

## Nanoscopic tannic acid - ZnO colloid: low temperature synthesis and the influence of pH on the aggregates

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### ABSTRACT

The non-toxic tannic acid (TA)—zinc oxide (ZnO) nanocolloid has been facilely synthesised and characterised for consideration as a multifunctional nanostructure in a variety of application. The work presents a green hydrothermal synthesis of ZnO nanocolloids in the presence of an aqueous TA which acts as both a capping as well as a structure directing agents. The aim of the work is particularly to extend the capability of ZnO on the light absorption spectrum toward the visible light region. The sol-gel hydrothermal reaction took less than 5 h due to the reaction of gallotannin with citrate derivatives at low reaction temperatures (40 to 55 °C). The properties of the nanoscopic size of TA-ZnO colloids were well characterised by combined characterisation techniques that include TEM, FESEM, UV–vis and PL. The particle size and morphological properties of TA-ZnO nanostructures are feasible to alter by varying the reaction temperatures with the reaction solution maintained at an alkali pH. The mean nanoparticle size obtained was as small as  $10 \pm 1.2$  nm. Although TA was noted to enfold around the ZnO nanostructures, the ZnO nanocolloids aggregates were not wholly influenced by TA as explored in this work. These findings suggest that TA could be a growth directing agent under alkaline conditions at low-temperature reactions. The overall results reflected that the exploration of eco-friendly TA-ZnO nanocolloids was a combination of pH solution and complexation reaction. This work will be one of the important means to understand further to which extent the TA performance influence the nature of ZnO nanocolloids at low-temperature process.

**Keywords:** ZnO nanocolloids, tannic acid, low temperatures, green hydrothermal reaction, pHvariation

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