The optical quantification measurement on aggregated aqueous ZnO nanostructures upon exposure to tannic acid

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ABSTRACT
Herein, a facile eco-friendly green hydrothermal approach was developed in the preparation of pristine, stable and safer aqueous zinc oxide (ZnO) nanostructures at high yield in the presence of tannic acid (TA) conducted both at low and high reaction temperatures (50, 70 and 90 °C). The TA acted as a reducing agent and also a stabiliser which later capped around the ZnO nanostructures. The absorption spectrum confirmed the formation of ZnO nanostructures with the intense peak range at ~365 to 405 nm. The acid-driven solvent based on the Brønsted-Lowry acid/base theory described the acid solvent interaction in pristine ZnO-TA samples which caused the proton mechanism transfer between the Zn and oxygen components. Based on TEM and SEM analyses, pristine ZnO-TA nanostructures are well distributed and formed nanoplatelet hexagonal aggregate morphology upon the addition of TA with the smallest mean diameter size of 7 ± 1.2 nm. A surprising role of TA was also found out where the presence of TA could influence the formation of smaller ZnO-TA nanostructures upon the addition of TA (increased the H^+ concentration) at lower pH value (pH = 5) in pristine ZnO-TA samples which further influence the morphological formation of smaller nanostructures according to the pH of the aqueous solution. The complexation of reaction between Zn^{2+} and TA occurred mainly at pH = 7. At pH = 4, the presence of higher amount of H^+ molecules was responsible for the increased of Zn^{2+} which caused the formation of larger size aggregates of ZnO-TA nanostructures. These results indicated that the TA caused the dissolution of ZnO nanostructures due to the effects of combined pH solution modification and alteration of complexation reaction.

KEYWORDS
Optical properties; Quantification; Tannic acid; ZnO nanostructures

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