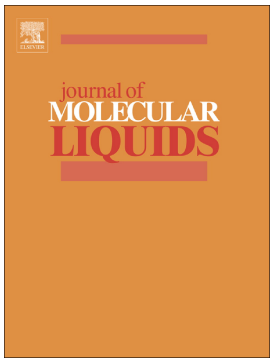

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Impact of solvent on the formation and optical properties of digestively ripened, ultra-small (r<2 nm) copper oxide quantum dots

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Abstract

Digestive ripening is a chemical size focusing process to produce monodispersed nanoparticles. Study on the influence of each synthetic parameter on digestive ripening, especially in the context of ceramic digestive ripening, is required to better understand the mechanistic aspects of the process. In the present work, we mainly explore the influence of the solvent (dielectric constant) on the digestive ripening of copper oxide quantum dots. To study the influence of the dielectric constant (ε ~80 to 16.9), water, ethylene glycol, methanol, ethanol, propanol, butanol, and pentanol are chosen as solvents. Digestively ripened copper oxide quantum dots having radius less than 2 nm are formed in case of all solvents. The shape, phase formed and stabilization against agglomeration are independent of the solvent. However, the particle size decreases with decrease in solvent dielectric constant. Also the standard deviation associated with the size-distribution decreases (~2.3 ± 0.5 nm with ε ~80; ~1.8 ± 0.3 nm with ε ~16.9). The particle size trends observed are consistent with solubility related arguments. Time resolved luminescence studies suggest that average life time of digestively ripened quantum dots (~11 ± 2 ns) is mostly invariant (within error bars)