

## **Electronic Supplementary Information (ESI)**

# **Understanding the effect of surfactants' hydrophobicity on the growth of lanthanum sulfide nanospheres in Water-in-Oil microemulsion: A detailed Dynamic light scattering, Small angle X-ray scattering, and Microscopic study**

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## Supplementary Material: Tables

**Table S1:** Detailed information on the W/O microemulsion preparation procedure.

Water and surfactant (Tween 20 or Tween 80) in a specified [Water]/[Surfactant] ratio ( $W_0 = 10$ ) were placed in a dry beaker with a specific amount of toluene and then put in a digital ultrasonic cleaner and sonicated for 30 sec. The turbid and viscous solution was thereafter titrated with 1-butanol with continuous stirring to attain the optimum clarity. The system was allowed enough to reach equilibrium; turbidity was not re-established after it had vanished. The amount of 1-butanol needed to form a stable microemulsion was estimated. At a fixed temperature of 303 K, the entire procedure was carried out by using Tween 20 as well as Tween 80 as surfactants. Therefore the respective volume percentage of toluene, water, surfactants and 1-butanol for each reverse micellar media are enlisted in the following table:

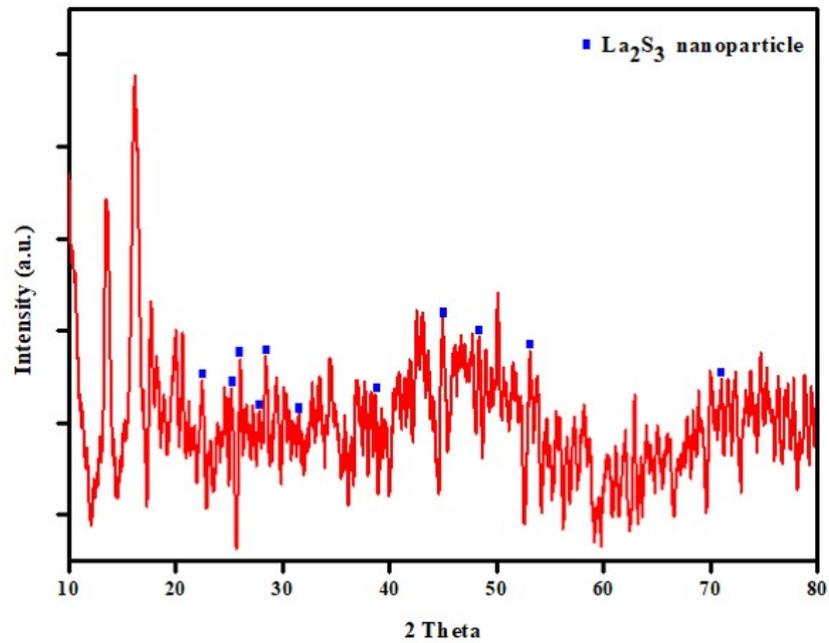
W/O microemulsion media	Toluene (%)	Water (%)	Surfactants (%)	1-butanol (%)
<b>Tween 20/1-butanol/toluene/water</b>	53.14	1.06	6.57	39.21
Tween 80/1-butanol/toluene/water	55.23	1.10	7.21	36.45

**Table S2:** Comparison of the slope of the Porod plot for the employed microemulsion media to synthesise the lanthanum sulfide nanoparticles.

W/O microemulsion media	Time (min)	Slope
<b>Tween 20/1-butanol/toluene/water</b>	15	41.80
	60	35.28
Tween 80/1-butanol/toluene/water	15	49.19
	60	45.23

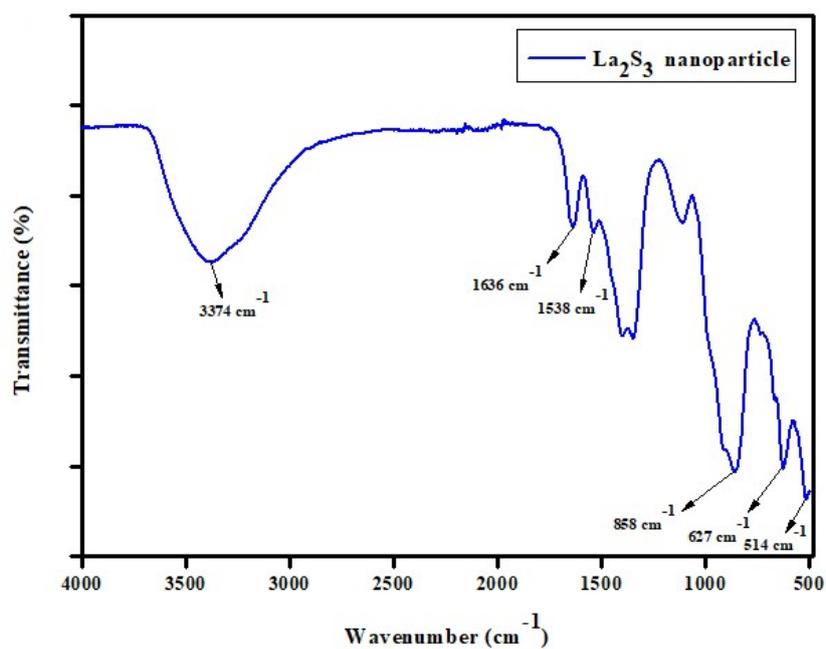
## Supplementary Material: Figures

**Fig S1:**



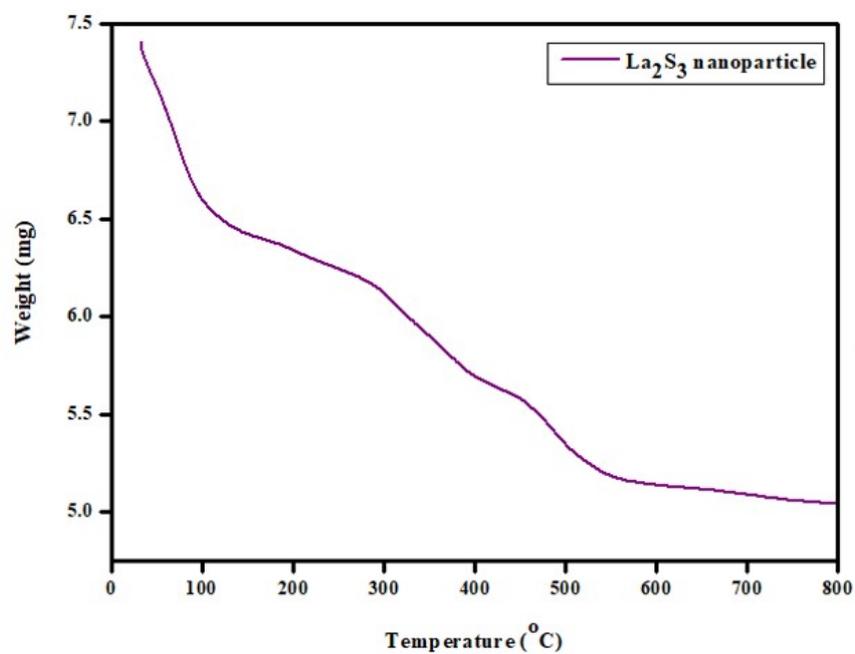
**Fig S1.** PXRD patterns of lanthanum sulfide nanospheres (synthesised from microemulsion, Tween 20/1-butanol/Toluene/lanthanum sulfide) at room temperature.

**Fig S2:**



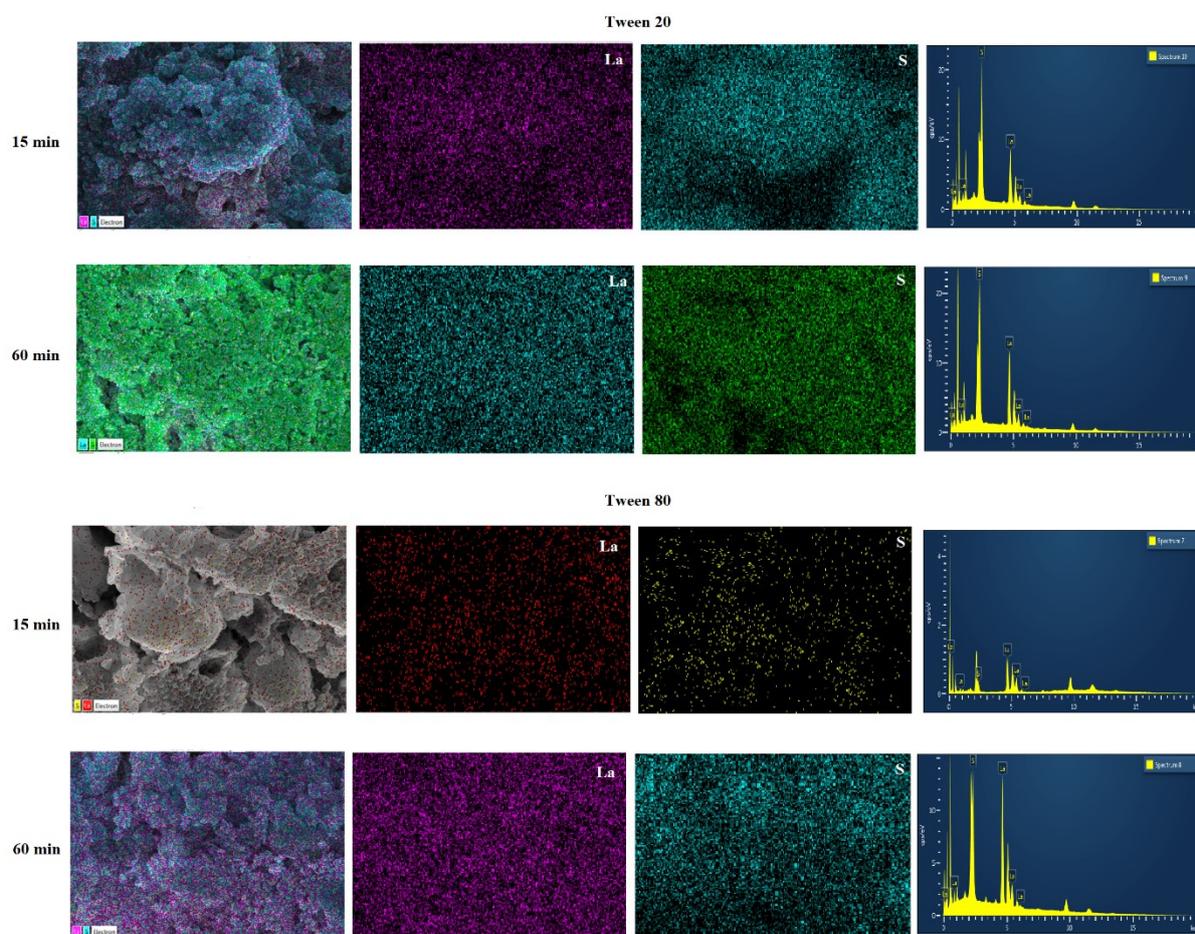
**Fig S2.** IR spectrum of lanthanum sulfide nanospheres (synthesised from microemulsion, Tween 20/1-butanol/Toluene/lanthanum sulfide) at room temperatures.

**Fig S3:**



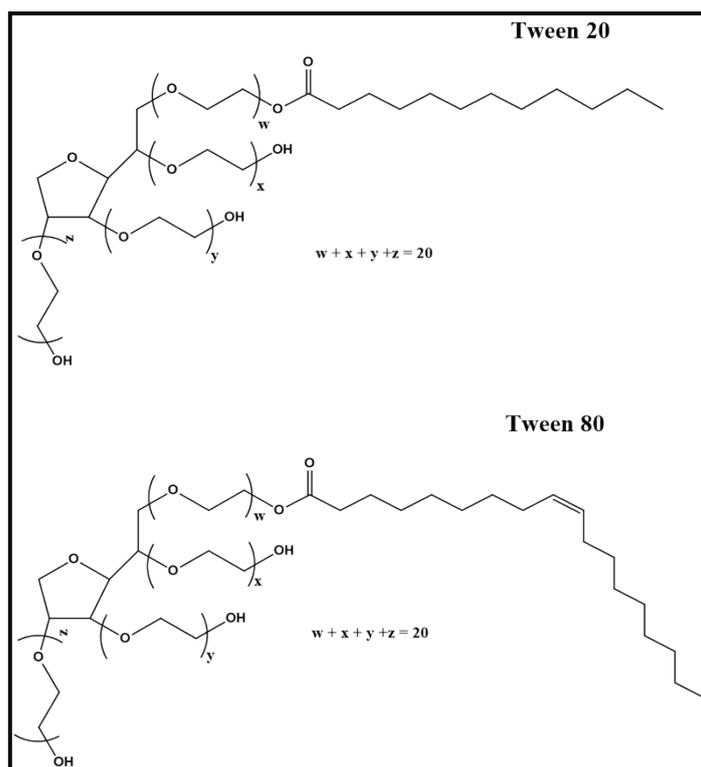
**Fig S3.** TGA curve of lanthanum sulfide nanospheres (synthesised from microemulsion, Tween 20/1-butanol/Toluene/lanthanum sulfide) at room temperatures.

**Fig S4:**



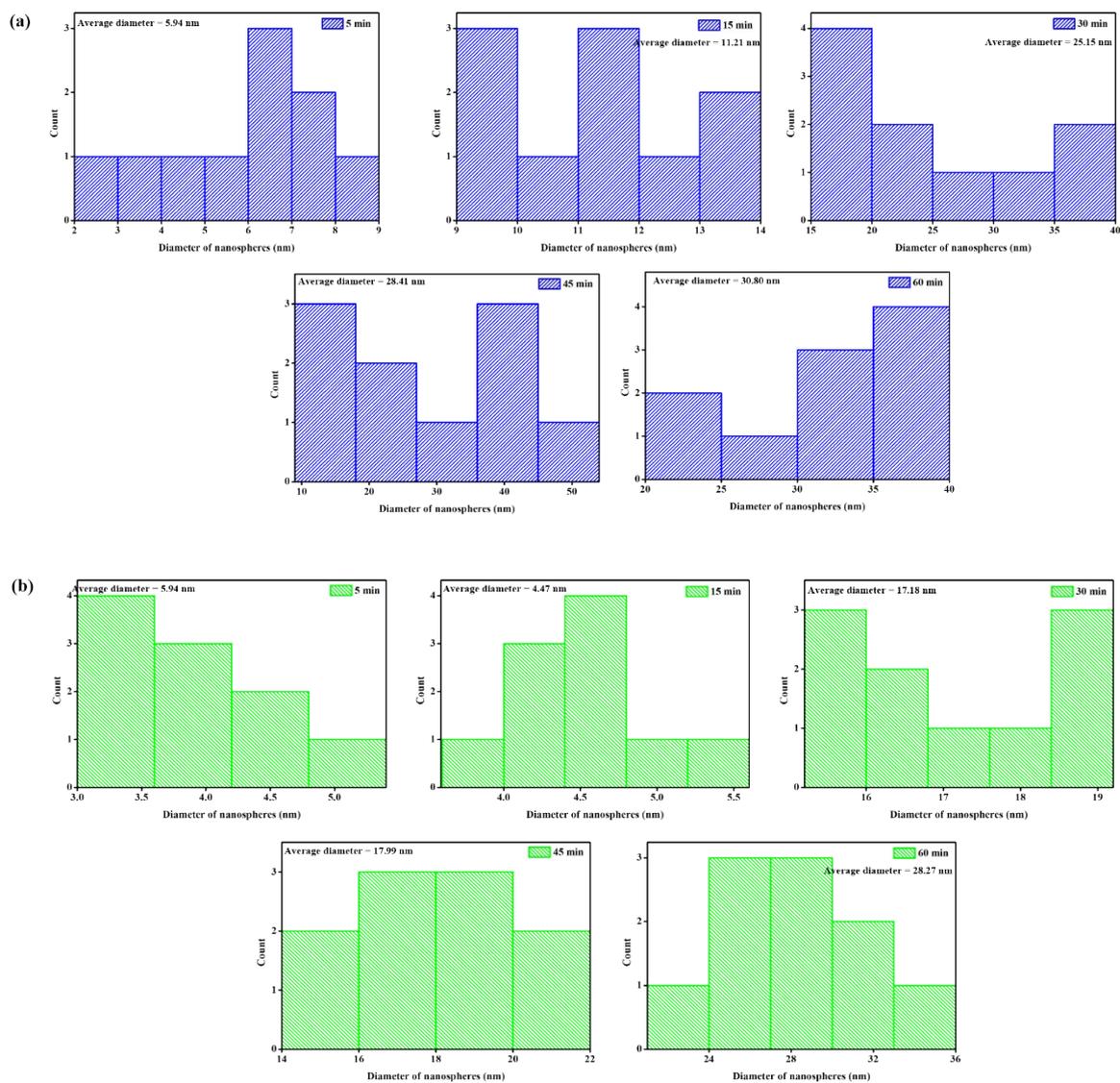
**Fig S4.** EDX patterns and electron mapping of lanthanum sulfide nanoparticles (synthesised from the microemulsion media composed by Tween 20 and Tween 80) at room temperatures after 15 and 60 min of the reaction.

**Fig S5:**



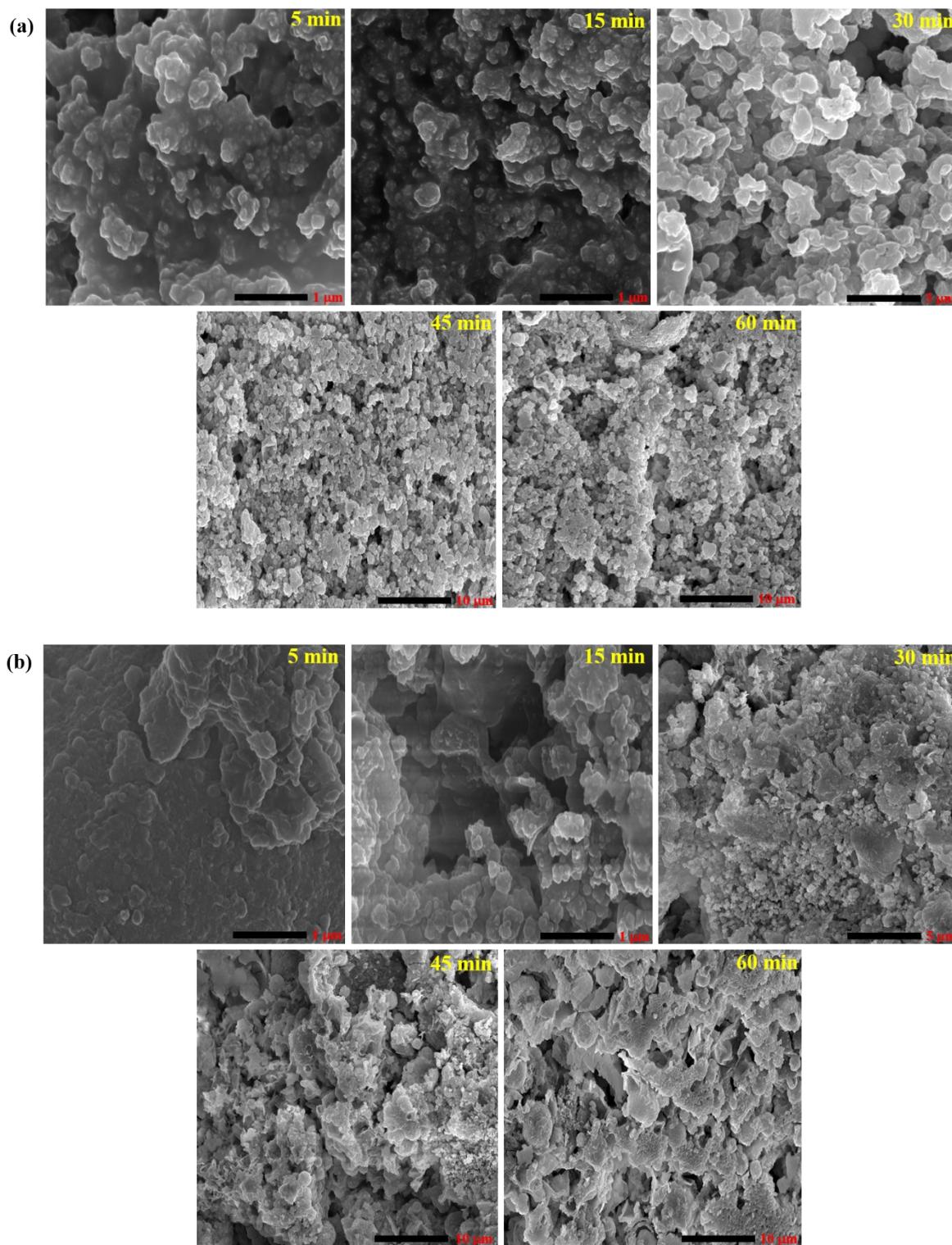
**Fig S5.** Structure of Tween 20 (have not any pi bond) and Tween 80 (showing the presence of  $\pi$ -bond at the hydrophobic tail).

**Fig S6:**



**Fig S6.** Particle size distribution of lanthanum sulfide nanospheres obtained from TEM analysis, at different time intervals, synthesised from the reverse micellar media constituted by (a) Tween 20 and (b) Tween 80.

**Fig S7:**



**Fig S7.** FESEM images of lanthanum sulfide nanoparticles at different time intervals, synthesised from the reverse micellar media constituted by (a) Tween 20 and (b) Tween 80.