Electronic Supplementary information

Facile biosurfactant assisted biocompatible α-Fe_2O_3 nanorods and nanospheres synthesis, magneto physicochemical characteristics and their enhanced biomolecules sensing ability

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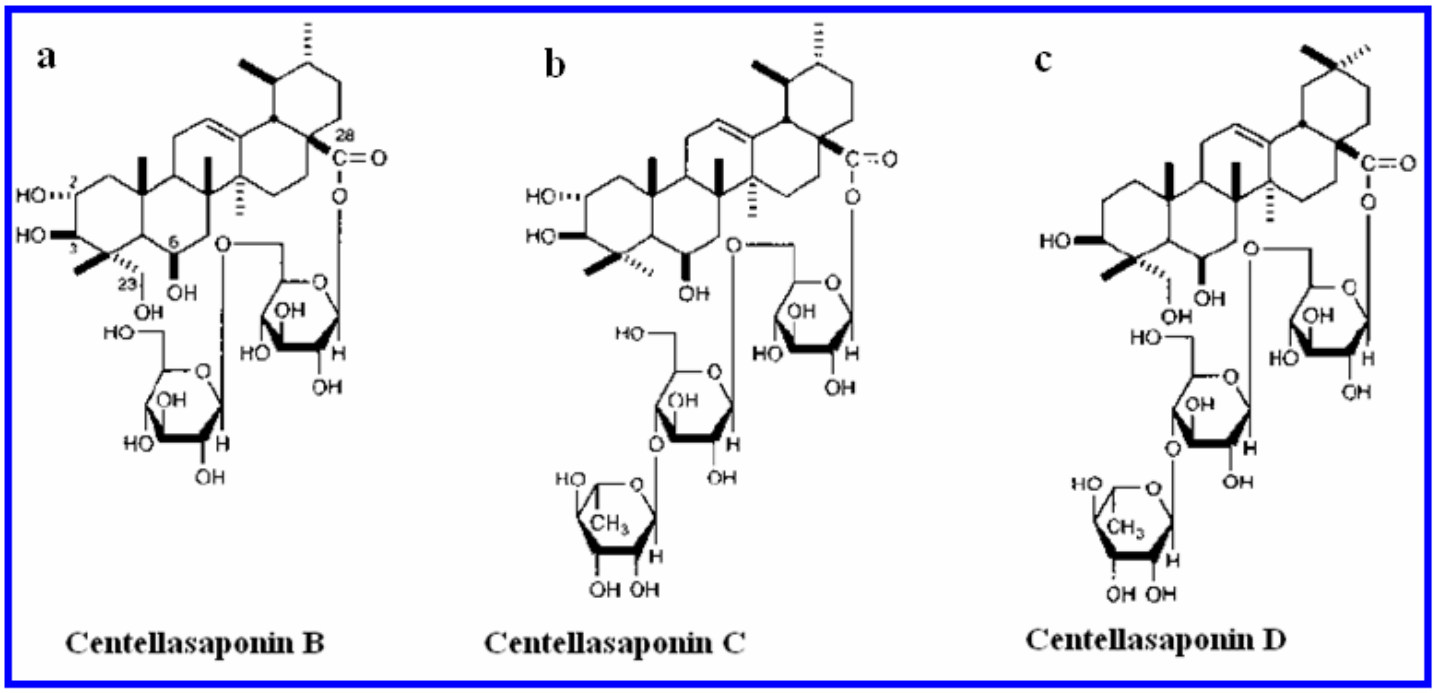

Fig. S1† Chemical structure of different types of Centellasaponin present in the Centella asiatica leaf extract[1]

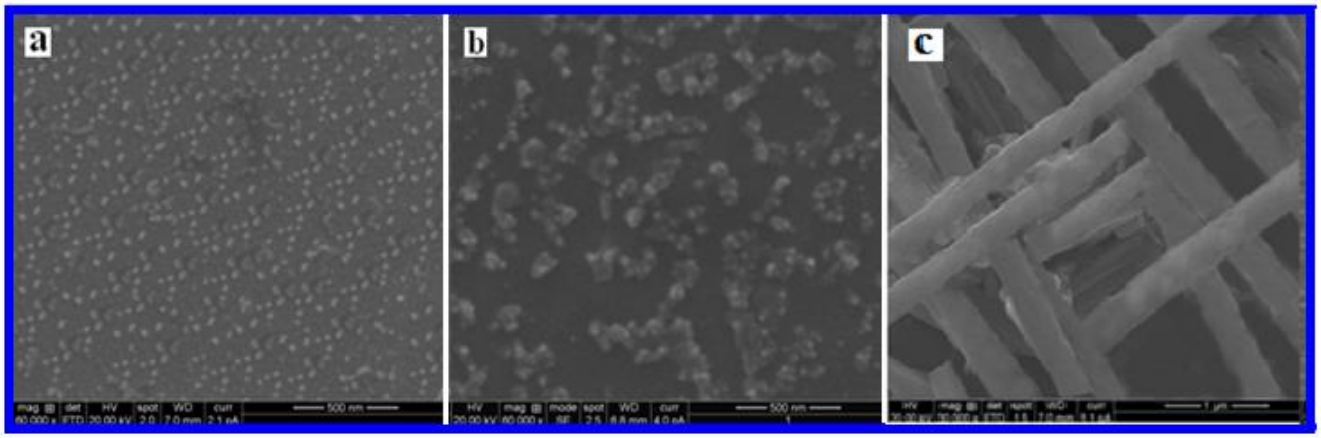

Fig. S2† FE-SEM images of α- Fe_2O_3 nanostructures synthesized in 2% CS concentration of at 10 minutes (a), 30 minutes (b) and 3hr (c) at 30 ºC

In order to understand the growth process of α- Fe_2O_3 nanorods, time dependent evolution of α- Fe_2O_3 nanorods has been studied. At shorter reaction time of 10 minutes, only α- Fe_2O_3 nanospherical particles are formed and the average diameter of the particle is about 20 nm. As the reaction time increased to 30 minutes, part of the nanospheres began to coalesce each other to form nanorods. Further increasing the reaction time for 3 hrs, well structured nanorods were produced through the oriented attachment of nanospheres.

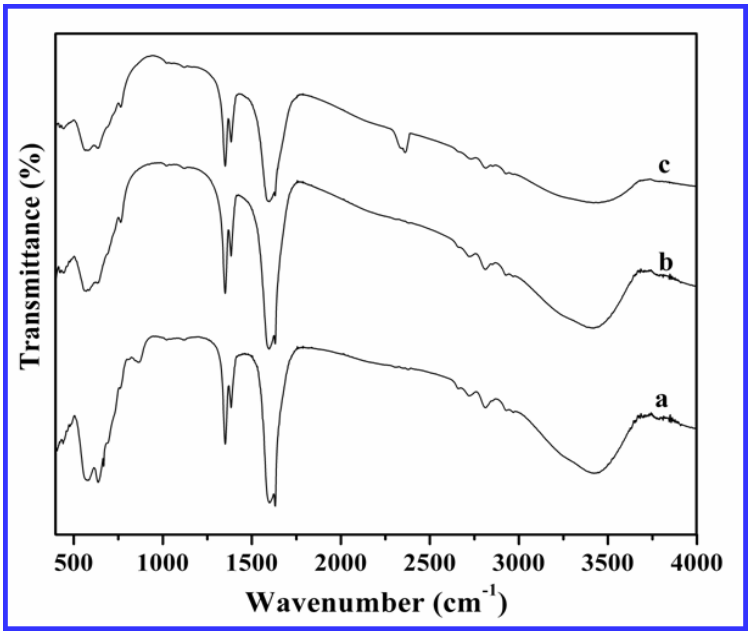

Fig. S3† FT-IR spectra of α-Fe_2O_3 nanostructures synthesized at 30 ºC in 3 hrs using 1% CS ((α-Fe_2O_3 nanorods) (a)), 2% CS ((α-Fe_2O_3 nanorods) (b)) and 10% CS ((α- Fe_2O_3 nanospheres)(c))

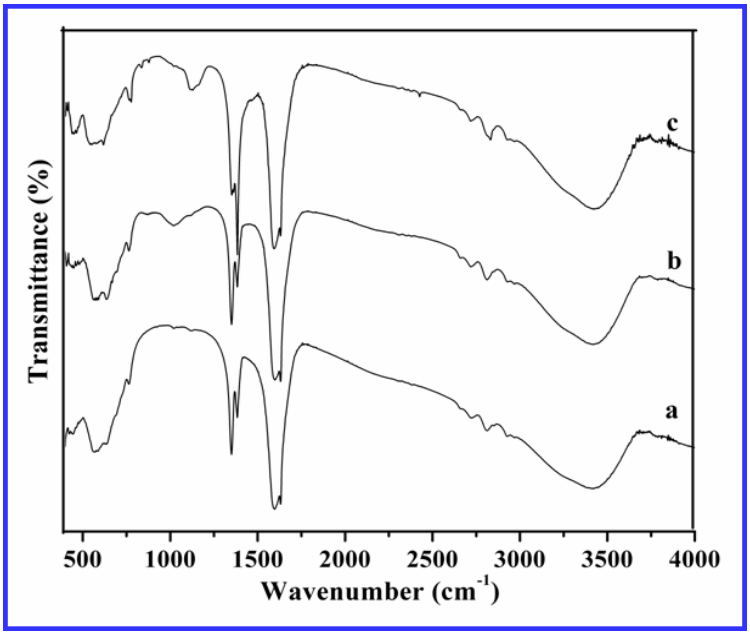

Fig. S4† FT-IR spectra of α-Fe_2O_3 nanostructures synthesized using 2% CS concentration in 3 hrs at 30 ºC (a), 40 ºC (b) and 60 ºC (c)

The wave number range of 3600-3100 cm^{-1} can be assigned for water hydration on the surface of iron oxide nanoparticles. Hydrate also absorbs in the range of 1622 cm^{-1} – 1500 cm^{-1}. This later band can be taken as another important means of identifying crystallization of water, which is present in all the synthesized hematite nanoparticles. In all the samples, the bands appeared in the range of 1350-1380 cm^{-1} indicates the presence of $–CH_3$ bending vibration of saponin molecule.

The existence of bands at around 567 and 445 cm^{-1} in all the samples synthesized at various conditions (different CS bio-surfactant concentration and reaction temperatures) are due to the Fe-O stretching vibrational mode from the α-Fe_2O_3 phase, which is very closely matches with the published reports[2]. Zhoa et al. attributed 536.57 and 460.09 cm^{-1} absorption bands to α-Fe_2O_3. Li & Co-workers claimed the bands of 570 and 480 cm^{-1} are due to the Fe-O vibrational mode of α-Fe_2O_3.

References

1. H. Matsuda, T. Morikawa, H. ueda, M. yoshikawa, Chem. Pharm. *Bull.*, 2001, **49**, 1368-1371.
2. R. Suresh, R. Prabu, A. Vijayaraj, K. Giribabu, A. Stephen, V. Narayanan, *Mater. Chem. Phys.*, 2012, **134**, 590-596.