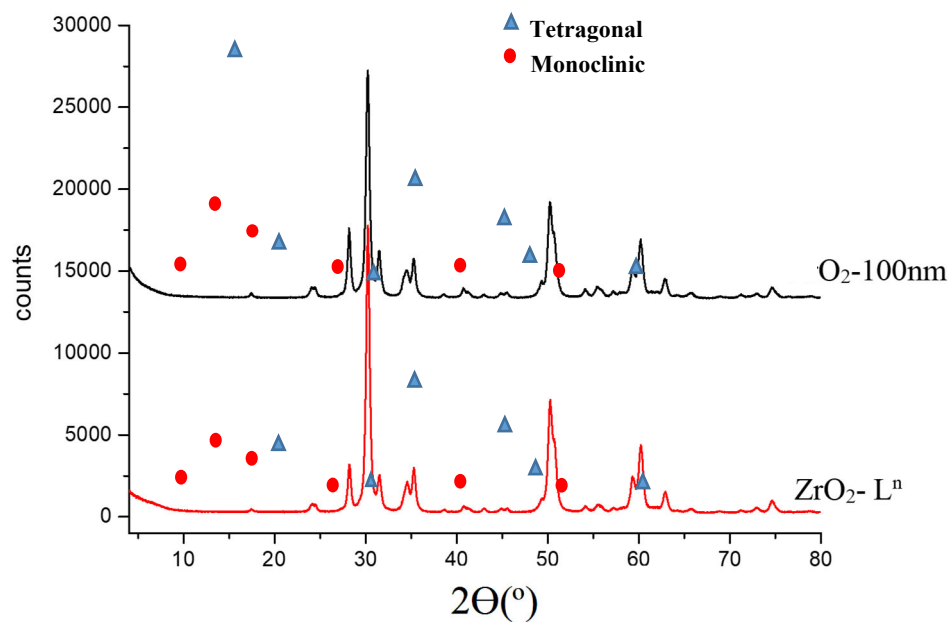
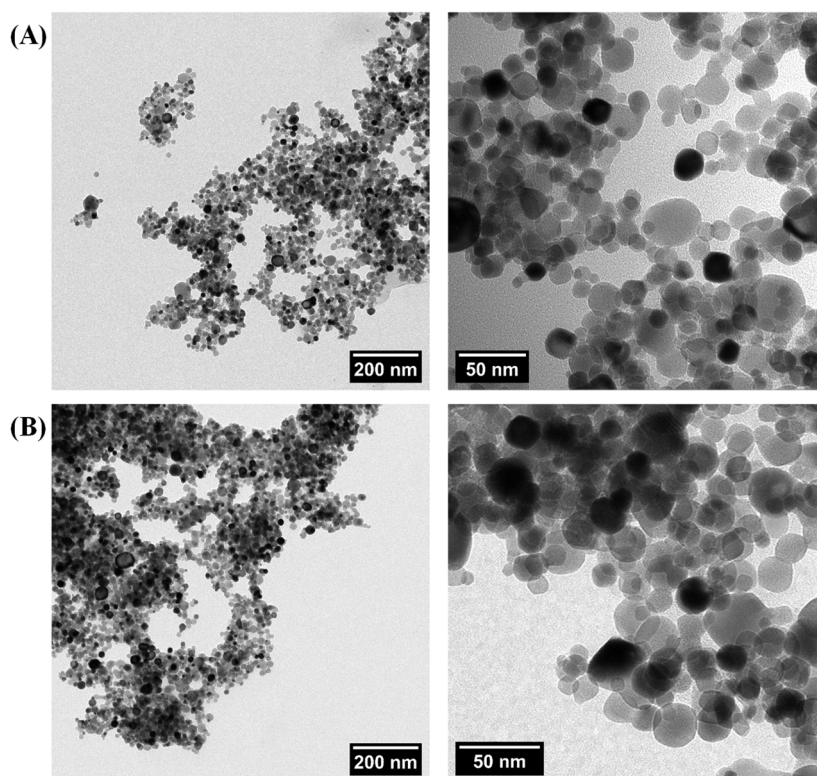


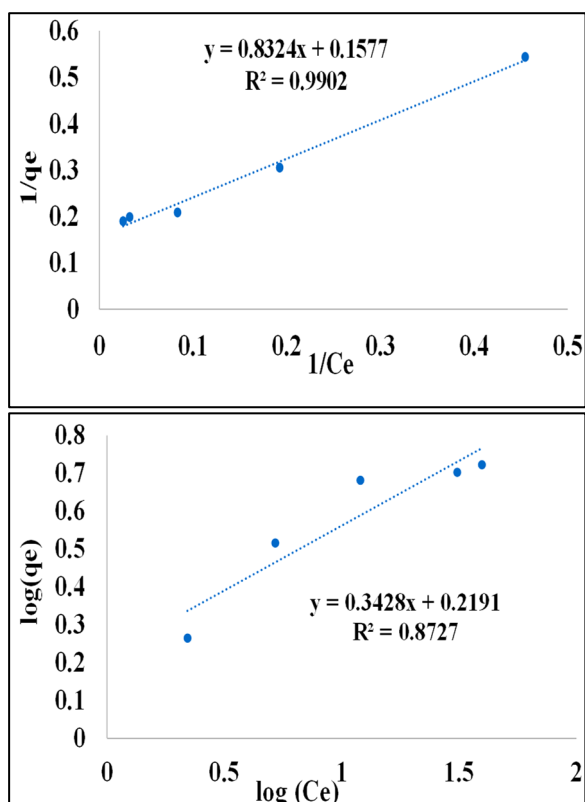
## Supplementary Materials



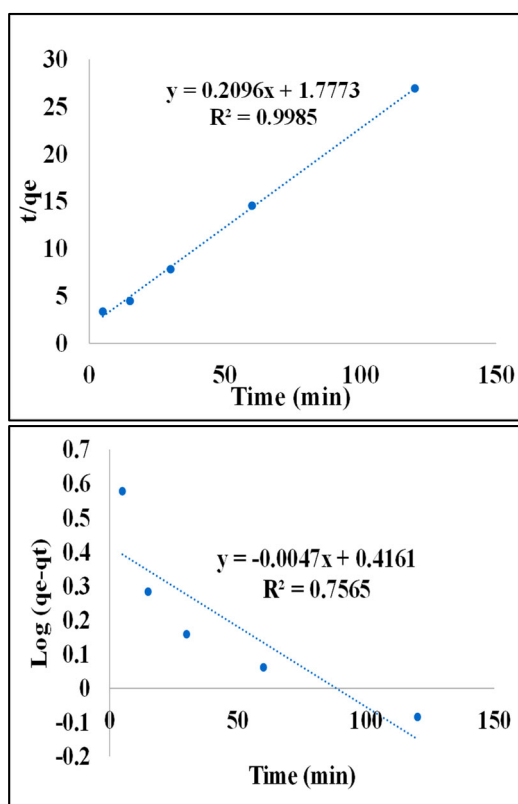
**Figure S1.** – XRD spectra of commercial  $\text{ZrO}_2$  (10 %wt) and modified  $\text{ZrO}_2\text{-L}^n$  nanoparticle.



**Figure S2.** – TEM images for (A) commercial  $\text{ZrO}_2$  (10 %wt) and (B) modified  $\text{ZrO}_2\text{-L}^n$  nanoparticles.



**Figure S3.** – a) Langmuir and b) Freundlich isotherms for Au(III) adsorption on  $ZrO_2-L$ .<sup>6</sup>



**Figure S4.** – a) Pseudo second order, and b) pseudo first-order models for Au(III) adsorption kinetics.

**Table S1.**  $^{31}\text{P}$  MAS chemical shift of phosphonic ligands ( $\text{L}^n$ ) and modified zirconia nanoparticles ( $\text{ZrO}_2\text{-L}^n$ ).

Ligands	Chemical shift (ppm)	$\text{ZrO}_2\text{-L}^n$	Chemical shift (ppm)
$\text{L}^1 = \text{DECMPA}$	15.9	$\text{ZrO}_2\text{-L}^1$	11.6
$\text{L}^2 = \text{DPCMPA}$	15.2	$\text{ZrO}_2\text{-L}^2$	11.9
$\text{L}^3 = \text{DOCMPA}$	18.3	$\text{ZrO}_2\text{-L}^3$	11.0
$\text{L}^4 = \text{DEHCMPA}$	19.2	$\text{ZrO}_2\text{-L}^4$	11.8
$\text{L}^5 = \text{DBCBA}$	29.2	$\text{ZrO}_2\text{-L}^5$	29.3 ; 22.2
$\text{L}^6 = \text{DBCBA}$	29.7	$\text{ZrO}_2\text{-L}^6$	29.3 ; 22.8