

Supporting Information

Biomilling of Rod-Shaped ZnO Nanoparticles: A Potential Role of *Saccharomyces cerevisiae* Extracellular Proteins

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The PL spectra of all biomilled samples were compared in figure S1. Generally, the PL spectrum of ZnO NPs show a narrow/strong peak in the UV region at ~ 370 nm, and broad/weak peak in the visible region at ~ 460 nm.¹ The PL peak in the UV range is assigned to near-band-edge transition (UV emission), which is due to the photo-generated electron recombination with holes in the valence band. Whereas, the PL peak in the visible range is assigned to deep level emission and can be due to the recombination of an electron in singly occupied (deeply trapped) oxygen vacancy with a photo-generated hole in the valence band.¹ However, in our case, only one peak at ~ 380 nm was found which was consistent with many other reports in the literature.² However, there was no consistency in the change in the intensity of the PL peak of different biomilled samples. The reason can be the contribution of two major components in fluorescence: (a) fluorescence from ZnO NPs,³ and (b)

fluorescence from coronal proteins.⁴ Both of these components were dynamic in nature *i.e.* decrease in the size of the ZnO NPs and change in the composition of protein corona as a function of biomilling time.

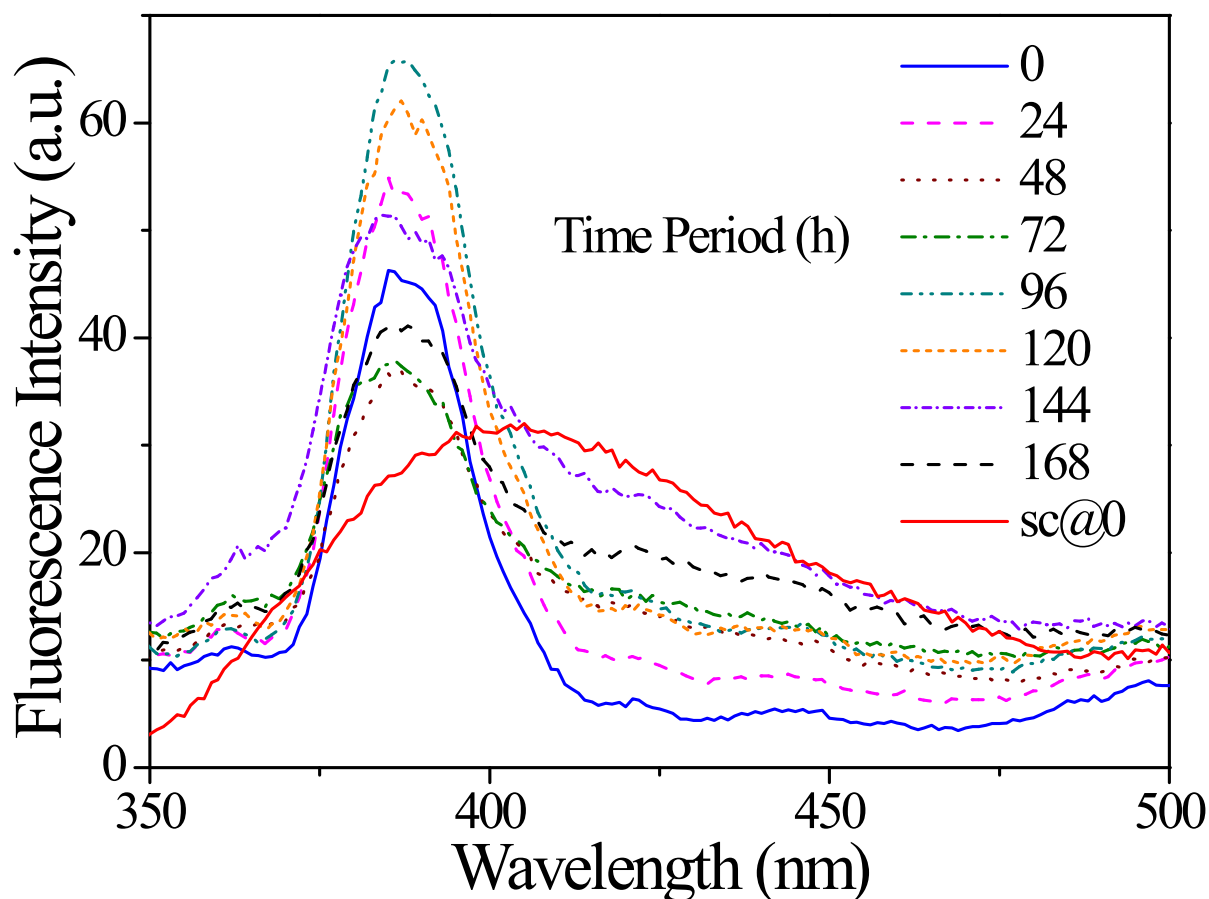


Figure S1. A comparison between photoluminescence spectra of ZnO NPs after different stages of biomilling (0, 24, 48, 72, 96, 120, 144 and 168 h) and supernatant of *S. cerevisiae* culture after 168 h (without ZnO NPs, as control and represented by sc@0) at an excitation wavelength of 325 nm.

FTIR spectroscopic measurements were performed on all biomilled ZnO NPs samples to evaluate the binding of proteins with ZnO NPs as shown in Figure S2. The FTIR spectra of all the samples were shown the characteristic peak of proteins which was included the amide B, amide I, amide II, and amide III peaks, and was positioned around ~ 3116 , 1736, 1589 and

1385 cm^{-1} , respectively.^{5,6} However, the position and relative intensity of peaks were varied as a function of biomilling time, which is related to the complex and dynamic nature of protein corona.

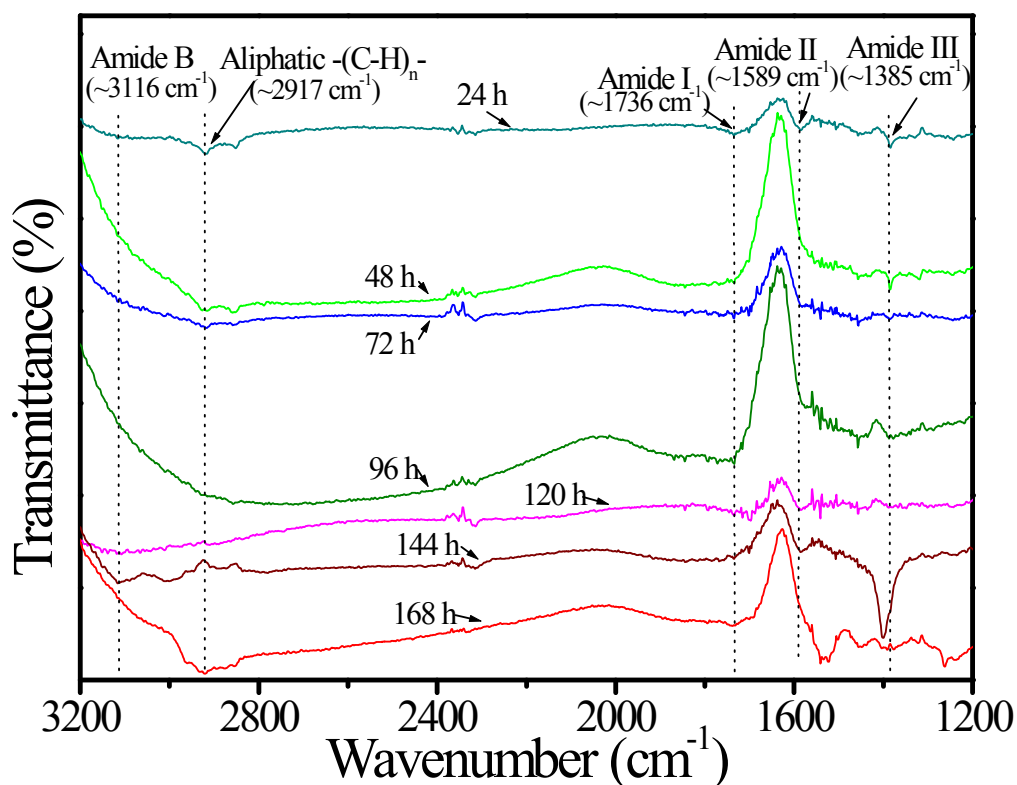


Figure S2. A comparison between FTIR spectra after ZnO NPs at different stages (24, 48, 72, 96, 120, 144 and 168 h) of biomilling.

TGA analysis was performed on the chemically synthesized ZnO NRs and biomilled ZnO NPs to know the presence of proteins on the biomilled ZnO NPs. The percentage weight loss upon heating from RT to 750 $^{\circ}\text{C}$ was shown by Figure S3. It was noticed that the heating of biomilled ZnO NPs upto 400 $^{\circ}\text{C}$ leads to $\sim 6.5\%$ weight loss which was quite high in comparison to the weight loss ($\sim 0.5\%$) observed for the chemically synthesized NRs and it was attributed to the loss of moisture and degradation of proteins.⁷

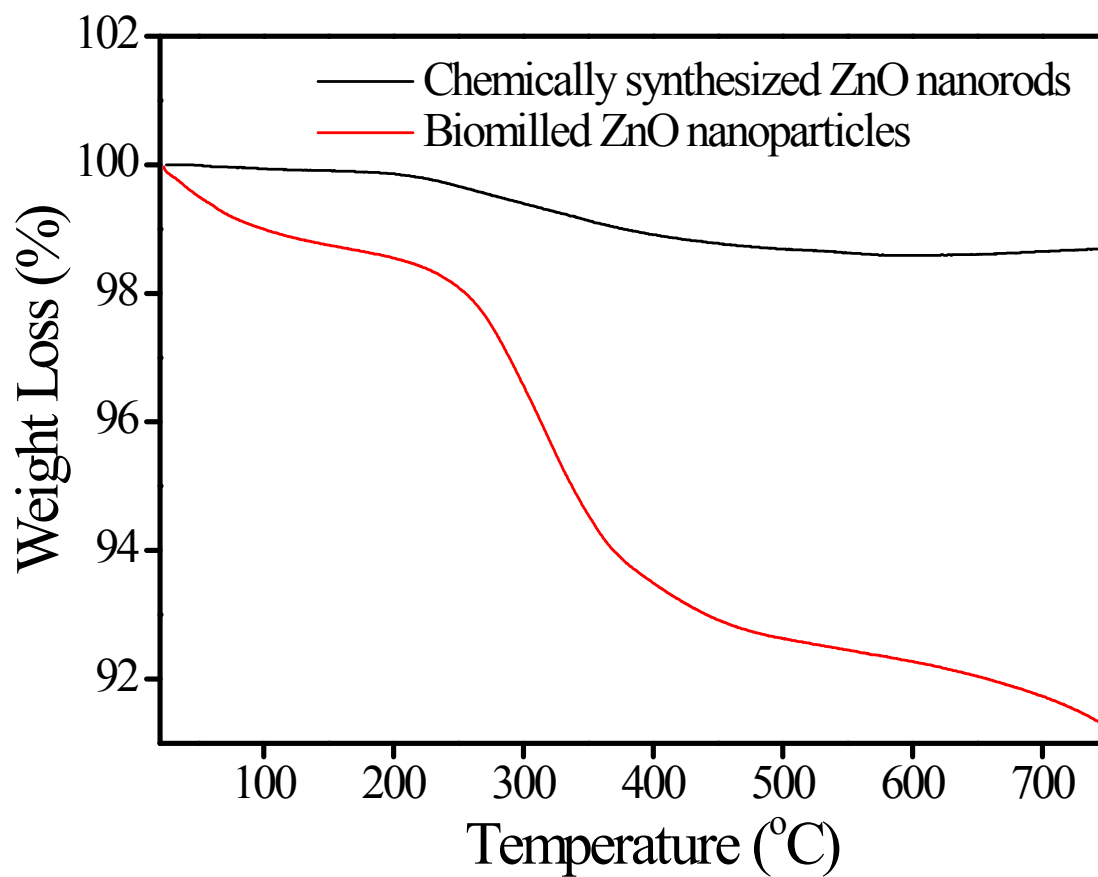


Figure S3. A comparison between TGA curves for the chemically synthesized ZnO NRs (before biomilling, black) and biomilled ZnO NPs (after 168 h of biomilling, red).

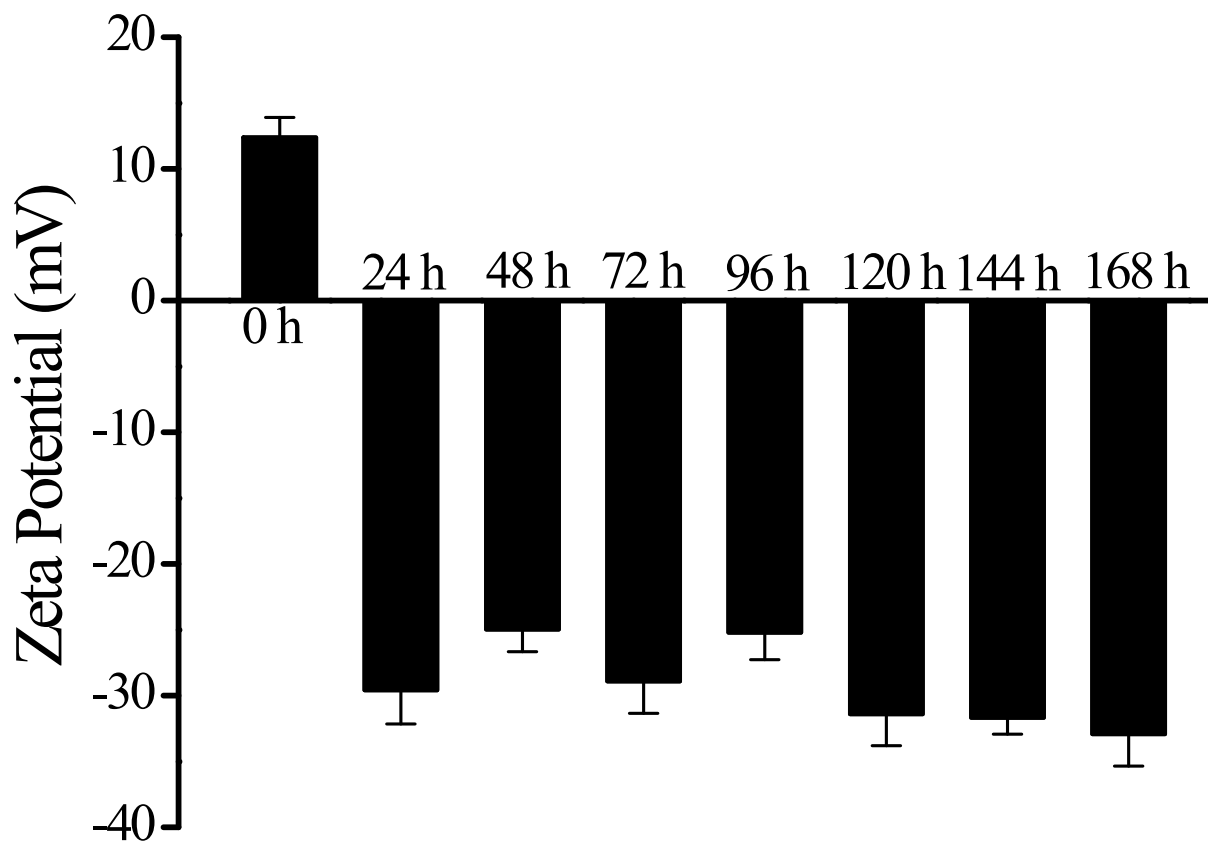


Figure S4. Zeta potential study of various ZnO NP samples before and after different stages (24, 48, 72, 96, 120, 144 and 168 h) of biomilling.

References

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