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Supplementary Material

Hydroponic grown tobacco plants respond to zinc oxide nanoparticles and bulk exposures by morphological, physiological and anatomical adjustments

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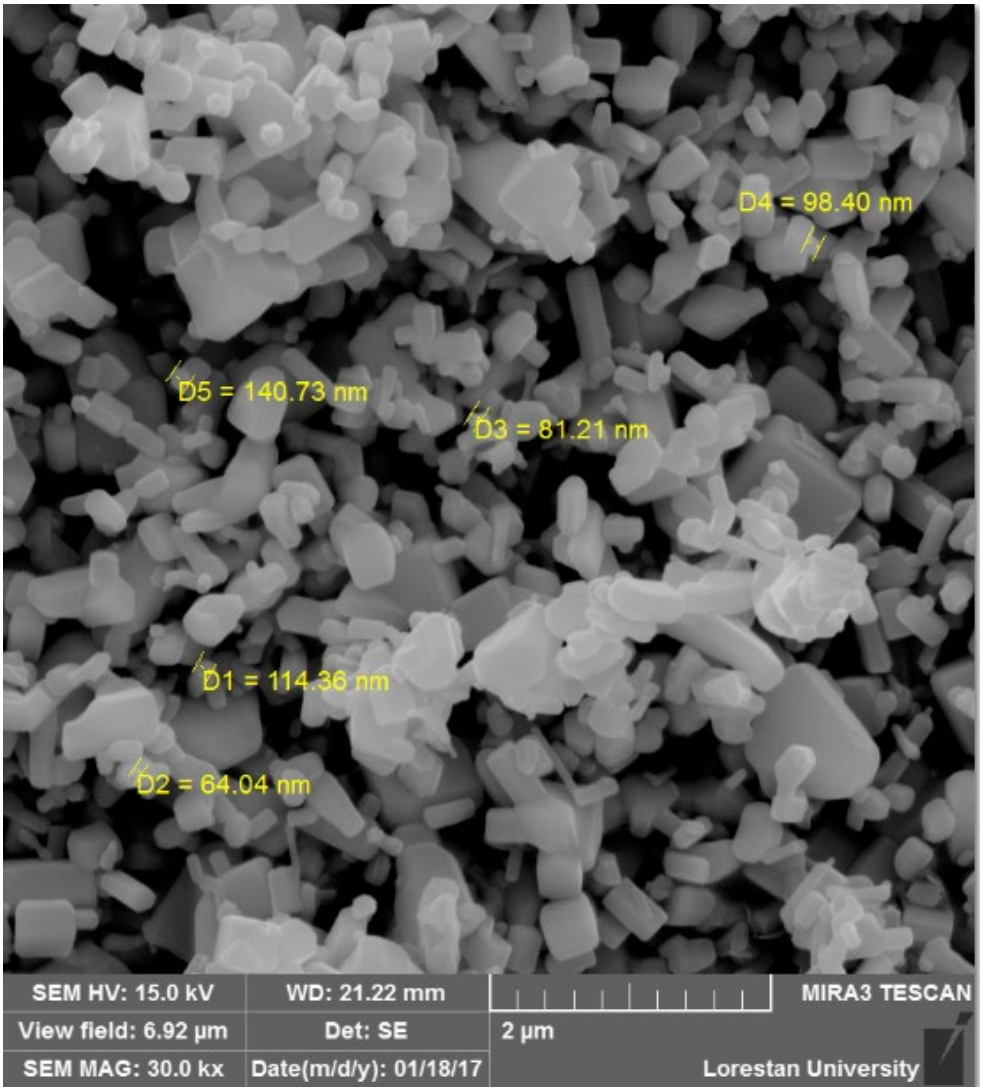
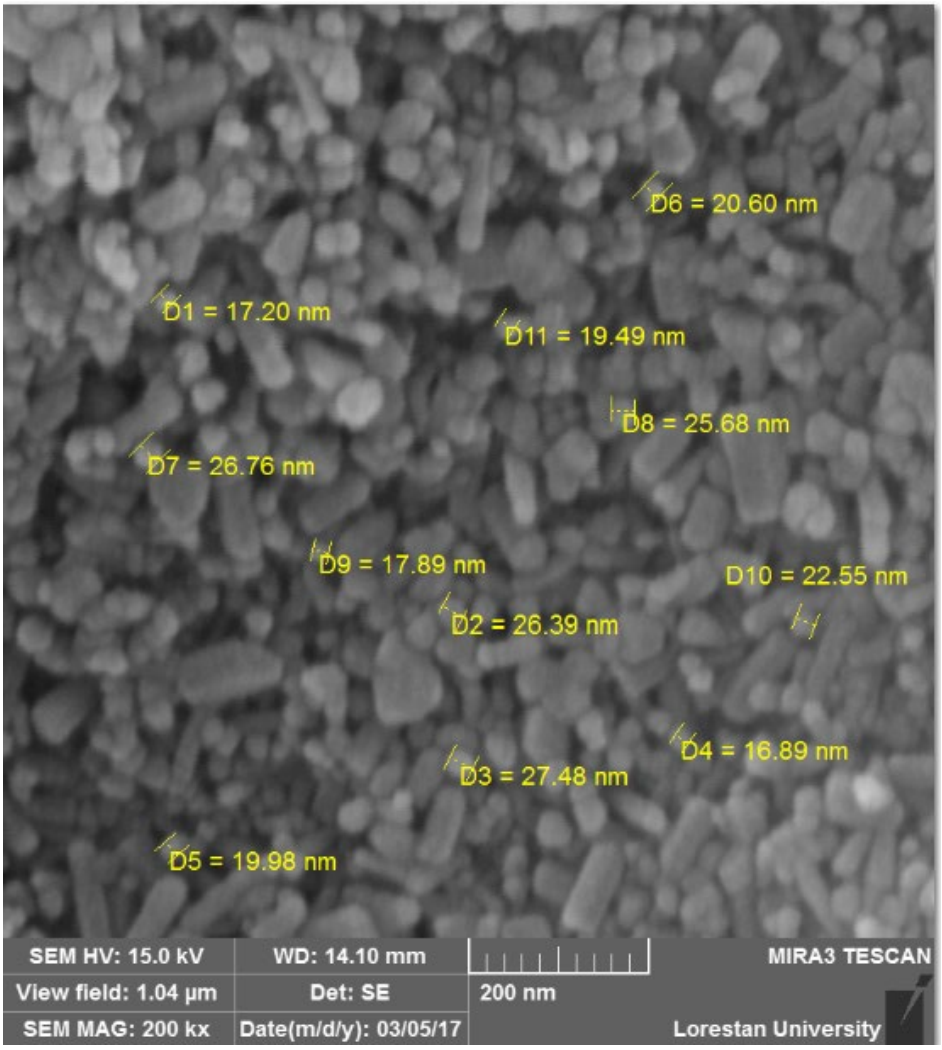
Figures A and B show SEM images of ZnO particles in the bulk and nano forms with approximately <1000 nm and 21.5 nm average sizes, respectively. SEM image (SEM, 15.0kV, MIRA3, TESCAN, Lorestan University).

(A) Bulk ZNO < 1000 nm, (D, diameter).



(B) NPs ZNO ~ 21.52± 4.05 nm, (D, diameter).



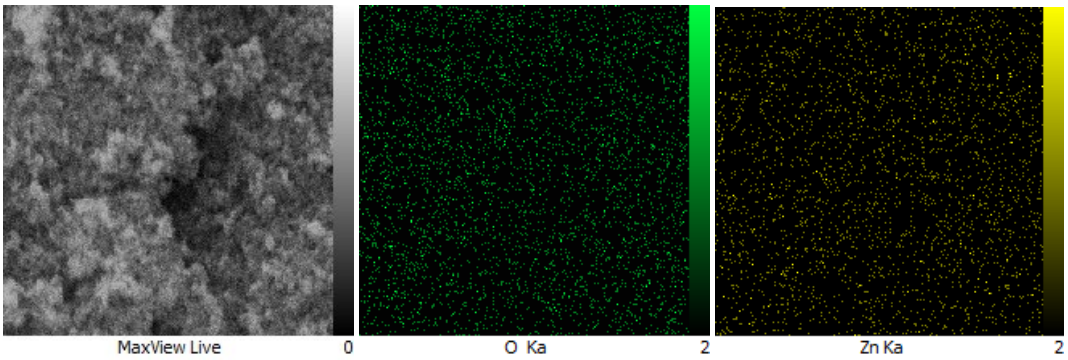
(C) Specification of XRD *(*X-ray diffraction); (X'PertPro, Holland, Panalytical company, Wavelength of x-ray beam [Cu Kα]:1.54 angstrom, Anod material: Cu, Voltage: 40 kV, Current: 30 mA);

Scherrer equation -XRD-Nano ZnO

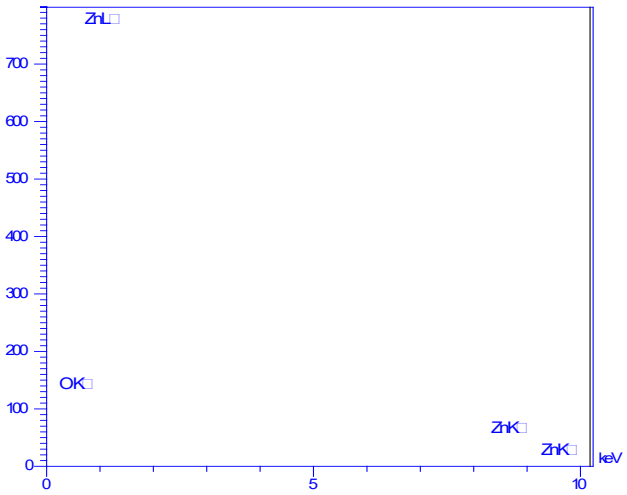
No.	Pos. [−2Th.]	FWHM [−2Th.]		Cos	
1	31.9755	0.2952	15.98775	0.96132	27.99571
2	34.6241	0.2952	17.31205	0.954699	28.18987
3	36.4629	0.3542	18.23145	0.9498	23.61539
4	47.7483	0.3542	23.87415	0.914437	24.52865
5	56.801	0.3542	28.4005	0.879644	25.49884
6	63.0496	0.4133	31.5248	0.85241	22.5508
7	66.5727	0.4133	33.28635	0.835938	22.99516
8	68.1302	0.4133	34.0651	0.828402	23.20435
9	69.2904	0.3542	34.6452	0.822688	27.26416
10	72.7185	0.2362	36.35925	0.805316	41.76667
11	77.1658	0.504	38.5829	0.781707	20.16515
				NPs ZnO (nm)	26.16134

Figures D and E show, energy dispersive analysis (EDX) of particles in both bulk and nano forms. Clearly, there is a homogeneous dispersion for zinc and oxygen elements in both cases.

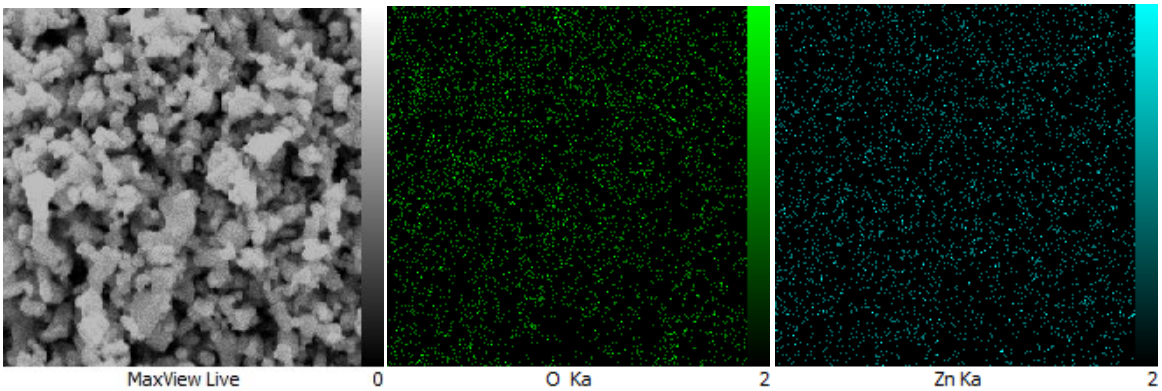
(D) Energy Dispersive Spectroscopy (EDX) of NPs ZnO.



EDX spectrum of NPs ZnO



E) Energy Dispersive Spectroscopy (EDX) of Bulk ZnO.



EDX spectrum of Bulk ZnO