Supporting Information

Green synthesis of zinc oxide particles with apple-derived compounds and their application as catalysts in the transesterification of methyl benzoates

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^{1}H-NMR scans were obtained using deuterated chloroform ($CDCl_3$-d_6) as solvent.
Chemical shifts were expressed in parts per million (ppm) relative to tetramethylsilane.
NMR spectra were recorded on a Bruker Avance 400 MHz (UltraShield Plus Magnet) spectrometers using the solvent peak as internal reference ($CDCl_3$: δ H 7.26. Multiplicities are indicated as s (singlet), d (doublet), t (triplet), q (quartet). Quantifications were performed upon integration of the selected peaks of the product against peaks of the substrate at 3.9 ppm.

Ethyl benzoylformate:
^{1}H NMR (400 MHz, $CDCl_3$): δ 1.38 (t, CH_3, 3H), 3.94 (s, OCH_3, 3H), 4.41 (q,CH_2, 2H), 7.47 (t, 2H), 7.65 (t, 1H), 8.00 (d, Ar, 2H).

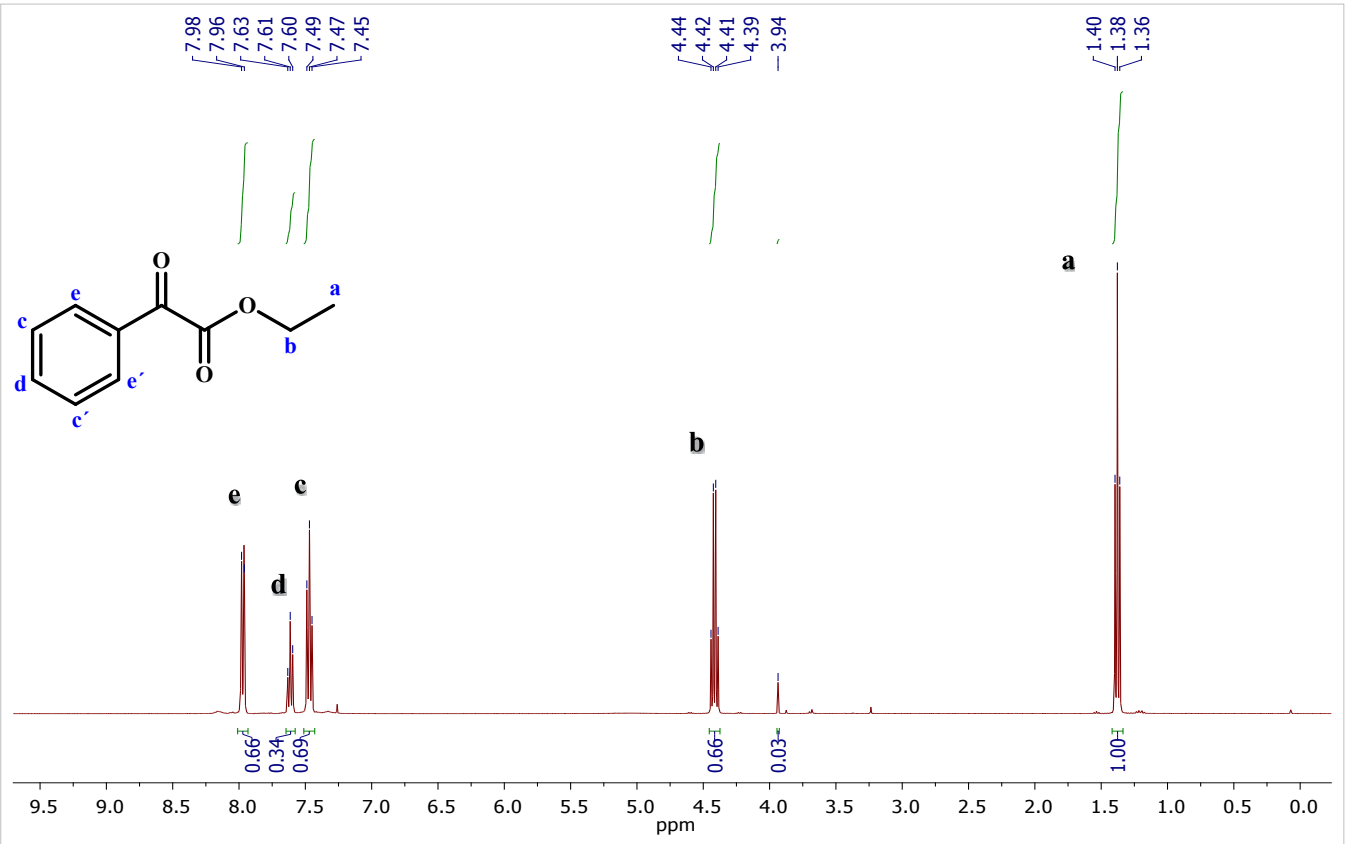

Figure S1. ^{1}H-NMR spectrum of ethyl benzoylformoate (Table 2, entry 6).

Ethyl 4-nitrobenzoate:

^{1}H NMR (400 MHz, $CDCl_3$):δ 1.35 (t, 3H), 3.90 (s, 3H), 4.35 (q, 2H), 8.09 (t, 2H), 8.15 (t, 1H).

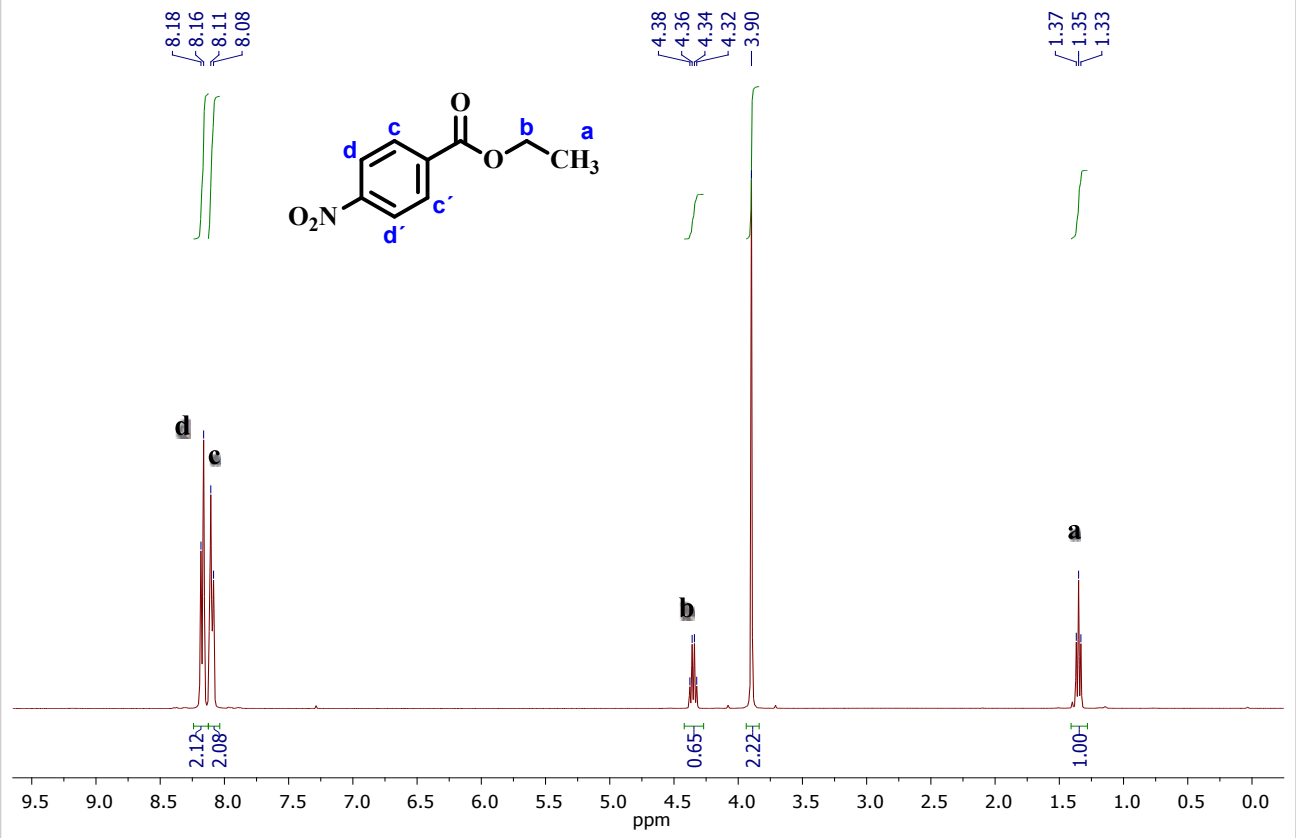

Figure S2. ^{1}H-NMR spectrum of ethyl 4-nitrobenzoate (Table 2, entry 18).

Table S1 – Elemental analysis determined by M.M. 8.6 (2009-05-06) (A.E.) method

Sample	N%	C%	H%
ZnONPs	0.71	5.18	<2.0
ZnOq	<0.5	4.35	<2.0

BET Analysis

Various information about the textural properties could be obtained through BET analysis. The specific surface area (S_{BET}) of the ZnO particles was determined from the nitrogen adsorption/desorption measurement applying the Bruneauer-Emmett-Teller (BET) method.

The BET surface area and pore volume are presented in Table S2. The diameter of the ZnO particles can be calculated by using the following equation:

$$d_{BET} = \frac{6000}{\rho_{sample}\, ample \times S_{BET}} \qquad (1)$$

where d_{BET} is the mean crystalline size (in nm), ρ_{sample} is the density of ZnO powder (ρ_{ZnO} = 5.60 g/cm^3) and S_{BET} is the BET specific surface area (m^2/g). Applying Eq. (1), d_{BET} values were obtained for ZnO samples (Table S2). The BET surface area and pore volume are presented in Table (S2). The N_2 adsorption-desorption isotherms for ZnO NPs, ZnOq and ZnO are displayed in Fig. (S3)

Table S2 – BET surface area, total pore volume, BJH pore diameter and mean crystalline size of ZnO samples.

Sample	S_{BET} (m^2/g)	Total Pore Volume (cm^3/g)	BJH pore diameter (Å)	d_{BET} (nm)	Type
ZnO	5	0.01408	180	214	II
ZnONPS	11	0.05713	279	97	II
ZnOq	17	0.04911	177	63	II

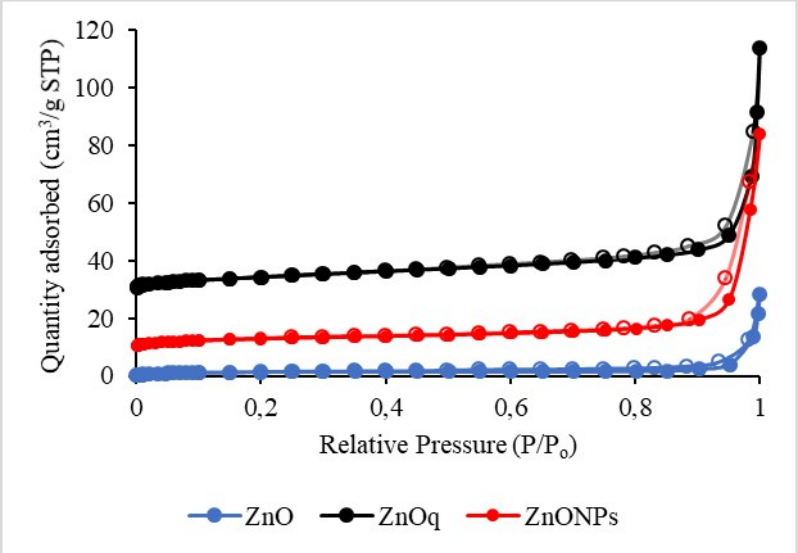

Figure S3 - N_2 adsorption/desorption isotherms of all the catalysts.