COMMUNICATION

Electronic Supplementary Information

A facile plant and chemical-mediated mechanosynthesis of α-Fe_2O_3 nanoparticles at room temperature

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1. Results and Discussion

Table S1: Mechanochemical milling conditions for the synthesis of Fe_2O_3

Entry	Precursor	Base	LAG (50µL)	Ball Size (mm)	Yield (%)
1	$FeCl_3.6H_2O$	NaOH	No Solvent	10	65
2	$FeCl_3.6H_2O$	NaOH	No Solvent	7	45
3	$FeCl_3.6H_2O$	Na_2CO_3	No Solvent	10	71
4	$FeCl_3.6H_2O$	Na_2CO_3	No Solvent	7	66
5	$FeCl_3.6H_2O$	Na_2CO_3	dH_2O	10	81
6	$FeCl_3.6H_2O$	Na_2CO_3	dH_2O	7	75
7	$FeCl_3.6H_2O$	Na_2CO_3	ACN	10	88
8	$FeCl_3.6H_2O$	Na_2CO_3	ACN	7	81
9	$FeCl_3.6H_2O$	Na_2CO_3	Hexane	10	69
10	$FeCl_3.6H_2O$	Na_2CO_3	Hexane	7	51

Reaction condition: 2 equivalences of $FeCl_3.6H_2O$ and 6 equivalence of NaOH or 3 equivalences of Na_2CO_3 were milled for an hour (60 minutes) at 23 Hz. In the case of a solvent used, only one droplet (50µL) was added.

Table S2: Mechanochemical milling conditions for the synthesis of Fe_2O_3 using plant material

Entry	Base	Solvent	Precursor:Plant	Ball Size
1	*A. afra*	No solvent	1:1	10 mm
2	*A. afra*	No solvent	1:0.5	10 mm
3	*A. afra*	No solvent	1:0.25	10 mm
4	*A. afra*	No solvent	1:1	7 mm
5	*A. afra*	No solvent	1:0.5	7 mm
6	*A. afra*	No solvent	1:0.25	7 mm
7	*A. afra*	dH_2O	1:1	10 mm
8	*A. afra*	dH_2O	1:0.5	10 mm
9	*A. afra*	dH_2O	1:0.25	10 mm
10	*A. afra*	dH_2O	1:1	7 mm
11	*A. afra*	dH_2O	1:0.5	7 mm
12	*A. afra*	dH_2O	1:0.25	7 mm

Reaction condition: 2 equivalance of $FeCl_3.6H_2O$ and the respective ratio of *A. afra* were milled for an hour at a frequency of 23 Hz. In the case of a solvent used, only one droplet was added.

1.1. Characterization techniques

1.1.1. PXRD

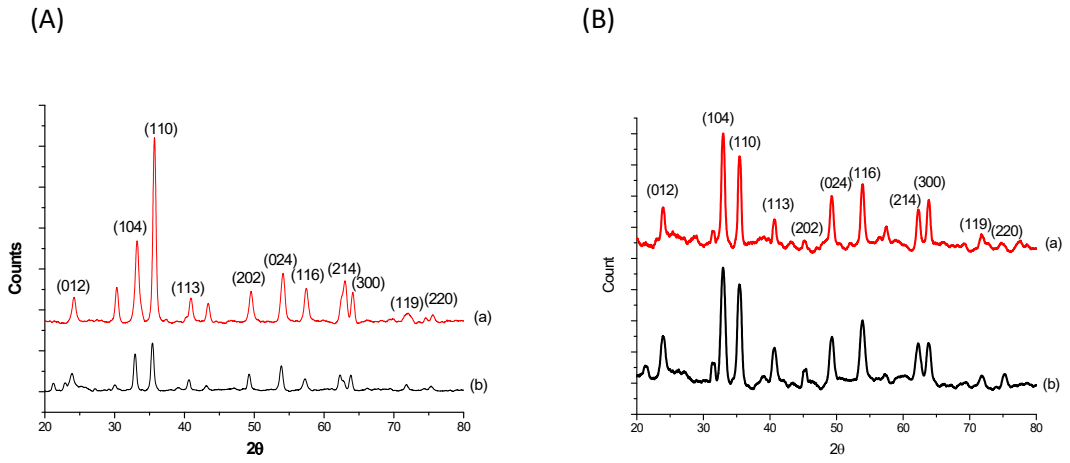

Figure S1.1: PXRD pattern of iron oxide nanoparticles when NaOH base for neat grinding (A) and LAG (B) using 10mm milling balls (b) and 7mm milling balls (a).

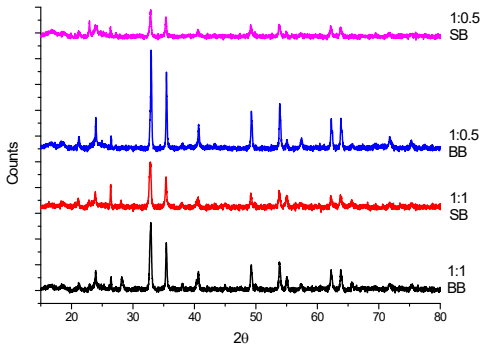

Figure S1.2: PXRD pattern of Fe_2O_3 nanoparticles for Plant:Fe-precursor ratio of reaction. SB: 7 mm balls and BB is 10 mm balls.

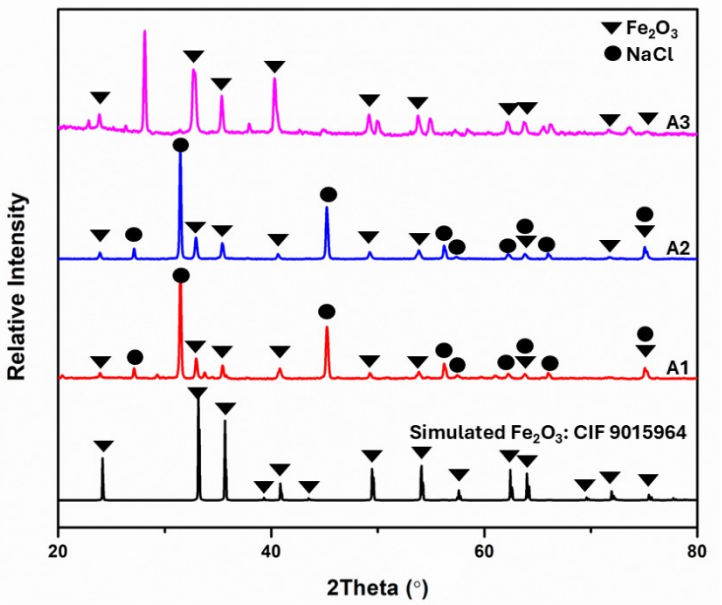

Figure S1.3: PXRD pattern of iron precursor and NaOH (A1), Na_2CO_3 (A2) and *A. afra* (A3) aged for an hour and calcined.

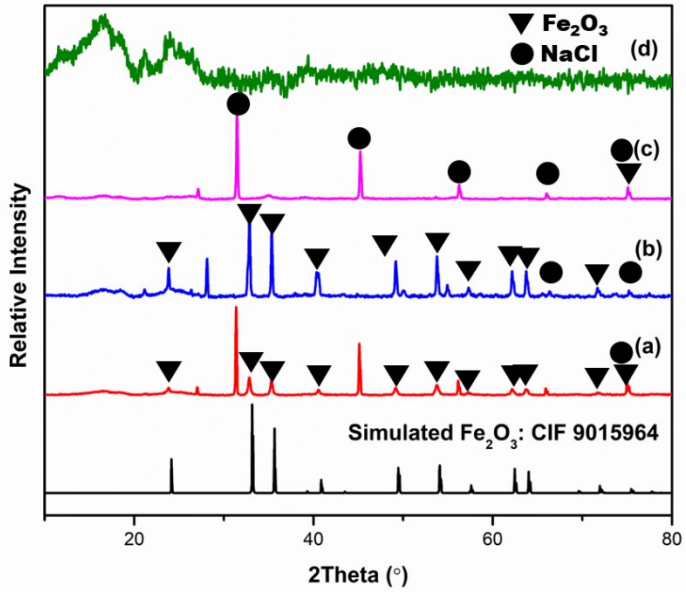

Figure S1.4: PXRD pattern of (a) calcined chemical-mediated milled product (no washing), (b) calcined plant-mediated milled product (no washing), (c) chemical-mediated as-milled product (no washing), and (d) plant-mediated as-milled product (no washing).

1.1.2. TEM

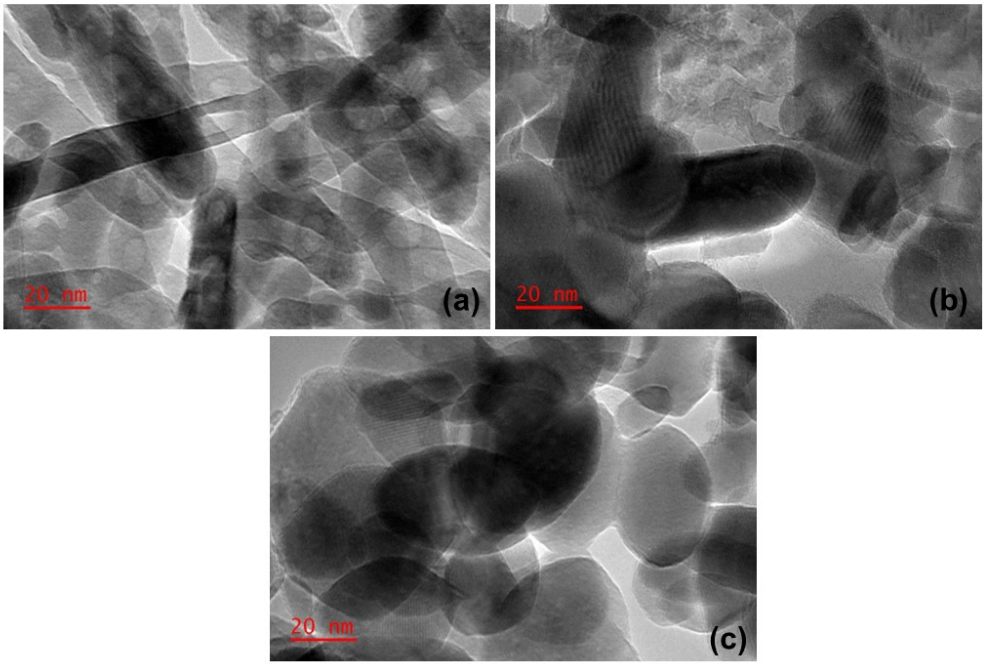

Figure S1.5: TEM images of Fe_2O_3-C (a), Fe_2O_3-P-LAG (b), and Fe_2O_3-C-LAG (c) in 20 nm magnitude.

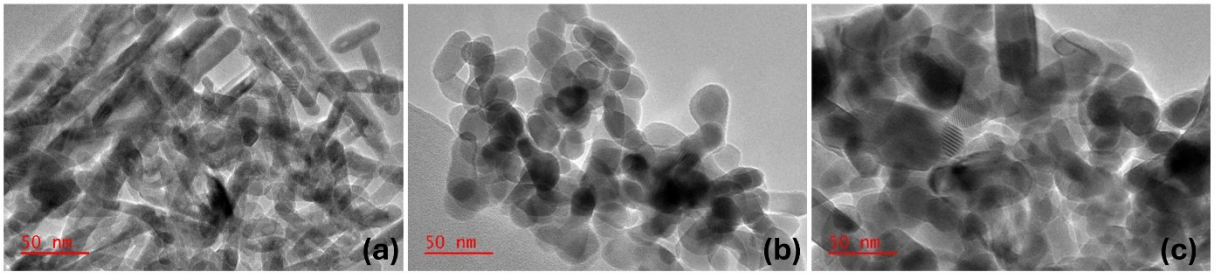

Figure S1.6: TEM images of Fe_2O_3-C when NaOH is used (a), Fe_2O_3-C-LAG (Acetonitrile) (b), and Fe_2O_3-P-LAG (Hexane) (c) in 50 nm magnitude

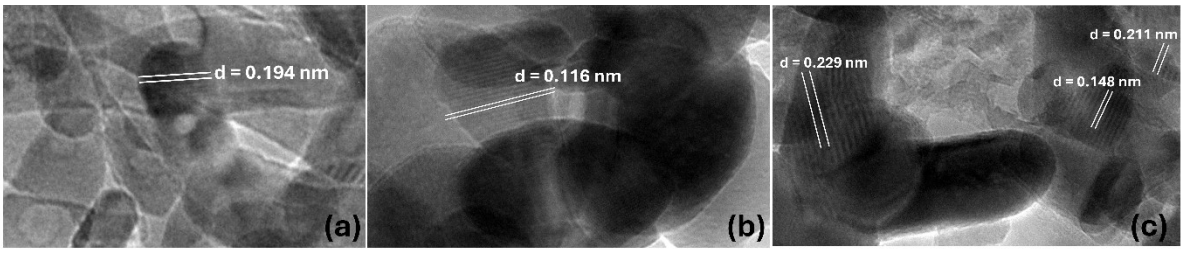

Figure S1.7: TEM images showing lattice fringes of Fe_2O_3-C (a), Fe_2O_3-C-LAG (b), and Fe_2O_3-P-LAG (c).

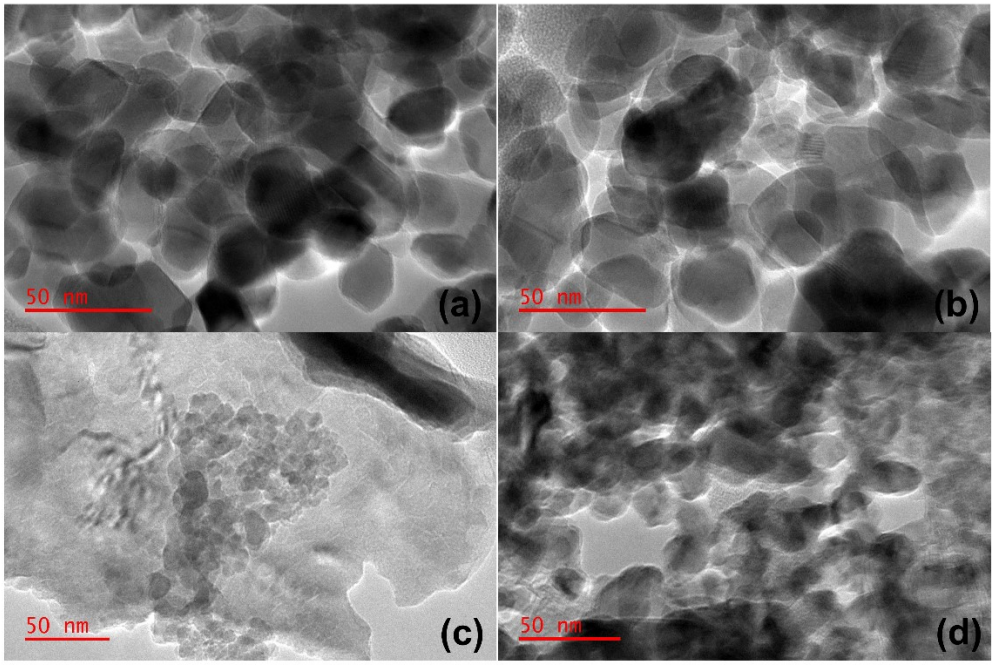

Figure S1.8: TEM images of iron oxide nanoparticles synthesised by (a) iron sulphate and (b) iron nitrate using Na_2O_3 as base; (c) iron sulphate and (d) iron nitrate using *A. afra* as base.

1.1.3 FTIR

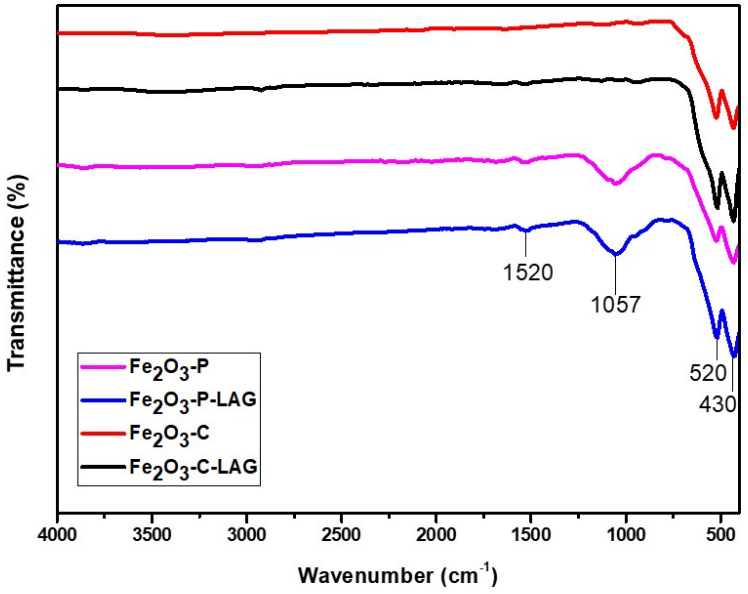

Figure S2: FTIR of iron oxide nanoparticles with neat grinding and LAG using Na_2CO_3 and plant material as base, respectively.