

## Supplementary Information

### Biomass derived cellulose nanofibers and iron oxide based nanohybrids for thermal insulation application

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#### Table of contents

Table S1: Zeta potential value of cellulose nanofibers (CNF).

Table S2: Table of Surface area and pore volume and pore size of CNF and CNF nanohybrid by one-pot synthesis. Obtained from desorption isotherm by BJH method.

Fig. S1: Characterization of CNF (a) Atomic Force Microscopy (AFM) images showed fiber like structure. Scale bar 2µm, (b) Dynamic Light Scattering (DLS) of CNF showed the hydrodynamic diameter in range of 20-30 nm.

Fig. S2: Zeta potential of cellulose nanofibers (CNF).

Fig. S3: Dynamic Light Scattering (DLS) of iron oxide nanoparticles showed the size of around 10-15 nm. (Synthesized by co-precipitation method)

Fig. S4: Conductometric titration curve of TEMPO-oxidized CNF.

Fig. S5: FESEM-EDX line scanning analysis for distribution of iron oxide nanoparticles along the surface of iron oxide@CNF nanohybrids (a) iron oxide@CNF-5%, (b) iron oxide@CNF-7% and (c) iron oxide@CNF-10%. Bar at count 20 showed a fixed level of iron oxide nanoparticles in the all three samples.

Fig S6: Digital image of iron oxide@CNF- 15 and 20% nanohybrids at the time of washing.

Fig. S7: Histogram developed from the corresponding FESEM study of (a) CNF aerogel and (c) iron oxide@CNF-2% nanohybrid, representing the amount of pore distributed in the (b) CNF and (d) iron oxide@CNF-2% nanohybrid.

Fig. S8: (a) Nitrogen adsorption and desorption isotherms, and (b) Barrett–Joyner–Halenda (BJH) pore size distribution of CNF and CNF nanohybrids.

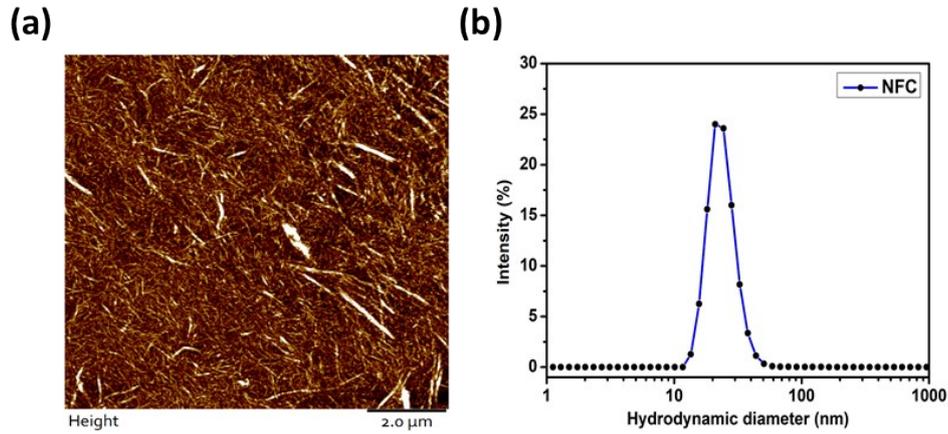
Fig. S9: (a) Thermal conductivity measurement of CNF and iron oxide@CNF nanohybrids with different wt % of iron oxide nanoparticles (0.75%, 1%, 1.5%, 2% and 3%) using transient hot wire method and (b) Plot of differential thermal conductivity values of the nanohybrid material with doping of different wt% of iron oxide nanoparticles.

**Table S1:** Zeta potential value of cellulose nanofibers (CNF).

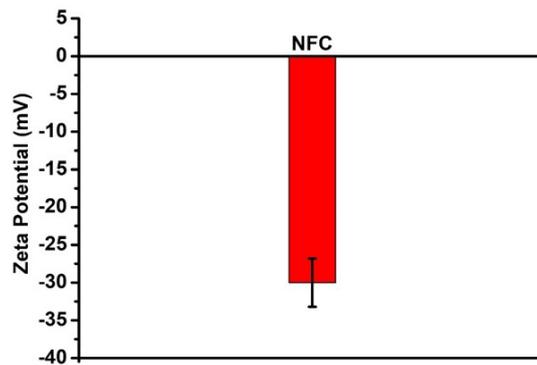
<b>Samples</b>	<b>Zeta Potential (mV)</b>
NFC	- 30 ±3.2

**Table S2:** Table of Surface area and pore volume of CNF and CNF nanohybrid by one-pot synthesis. Obtained from desorption isotherm by BJH method.

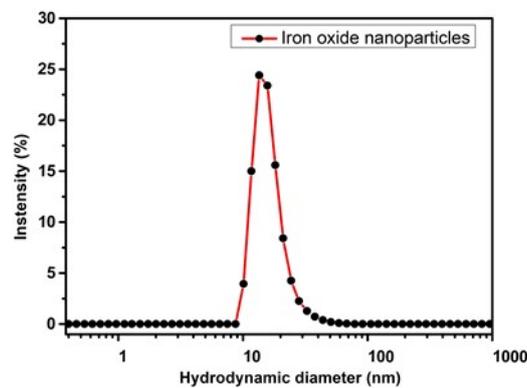
<b>Sample</b>	<b>Surface Area <math>S_{\text{BET}}</math> (<math>\text{m}^2 \text{g}^{-1}</math>)</b>	<b>pore volume (<math>\text{cm}^3 \text{g}^{-1}</math>)</b>
<b>CNF</b>	22.066	0.051
<b>iron oxide@CNF- 2%</b>	5.522	0.017
<b>iron oxide@CNF- 5%</b>	11.295	0.025
<b>iron oxide@CNF - 7%</b>	19.850	0.038
<b>iron oxide@CNF- 10%</b>	16.391	0.044



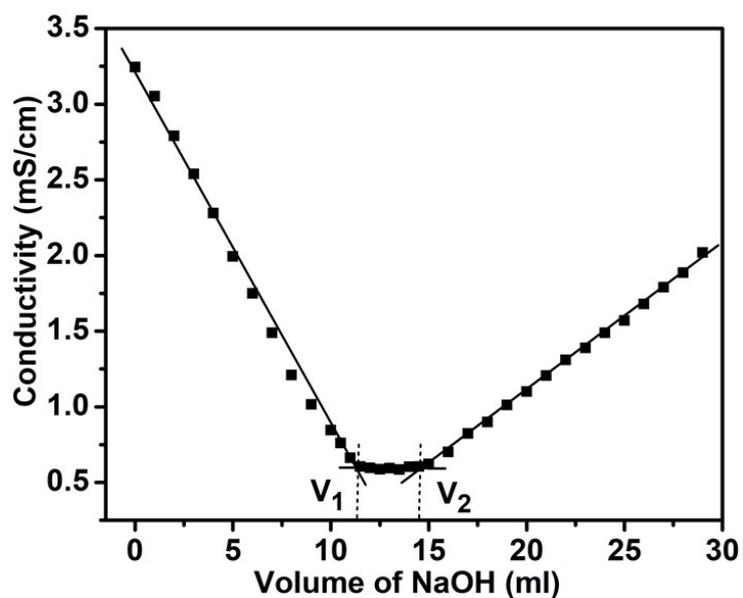
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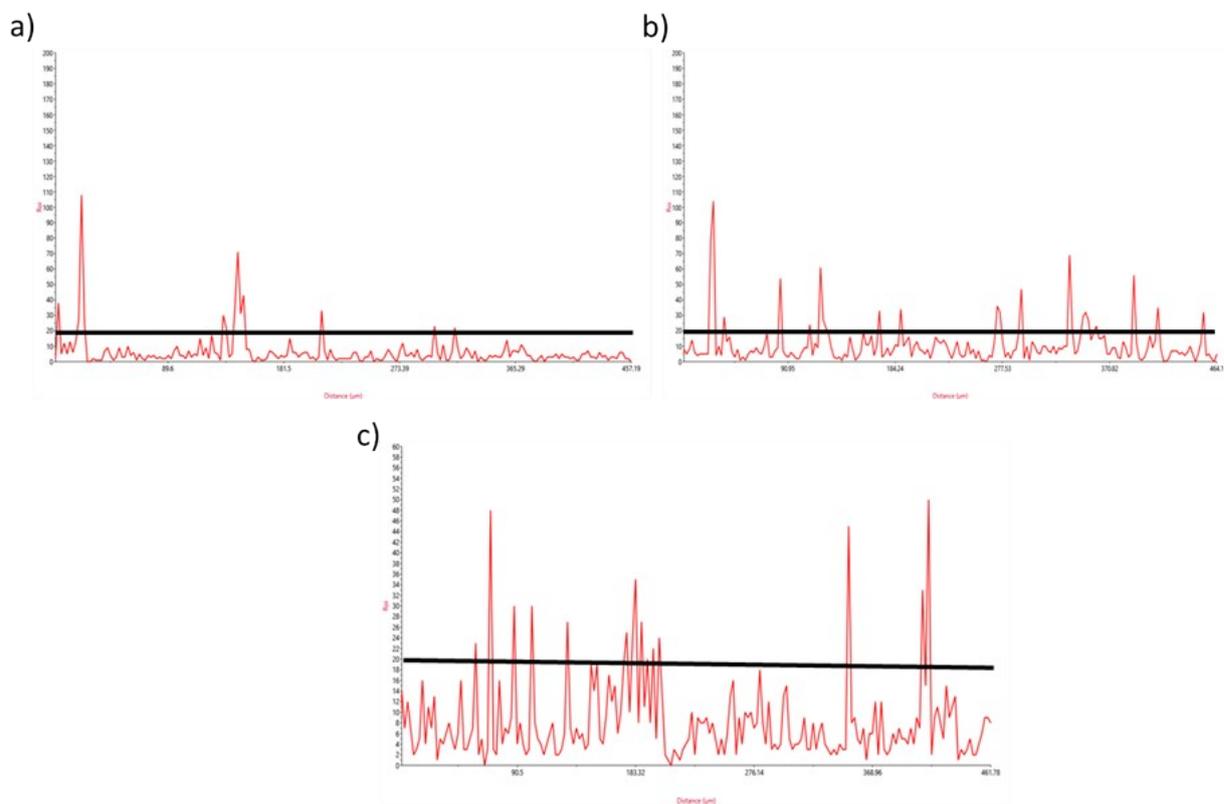
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**Fig. S3:** Dynamic Light Scattering (DLS) of iron oxide nanoparticles showed the size of around 10-15 nm. (Synthesized by co-precipitation method)

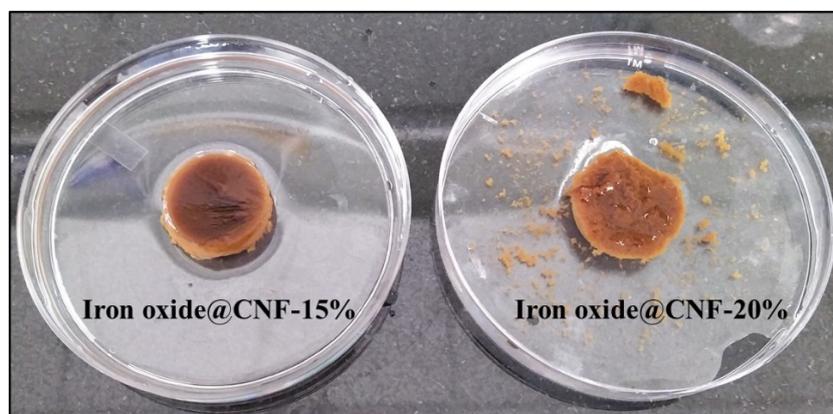


**Fig. S4:** Conductometric titration curve of TEMPO-oxidized CNF.



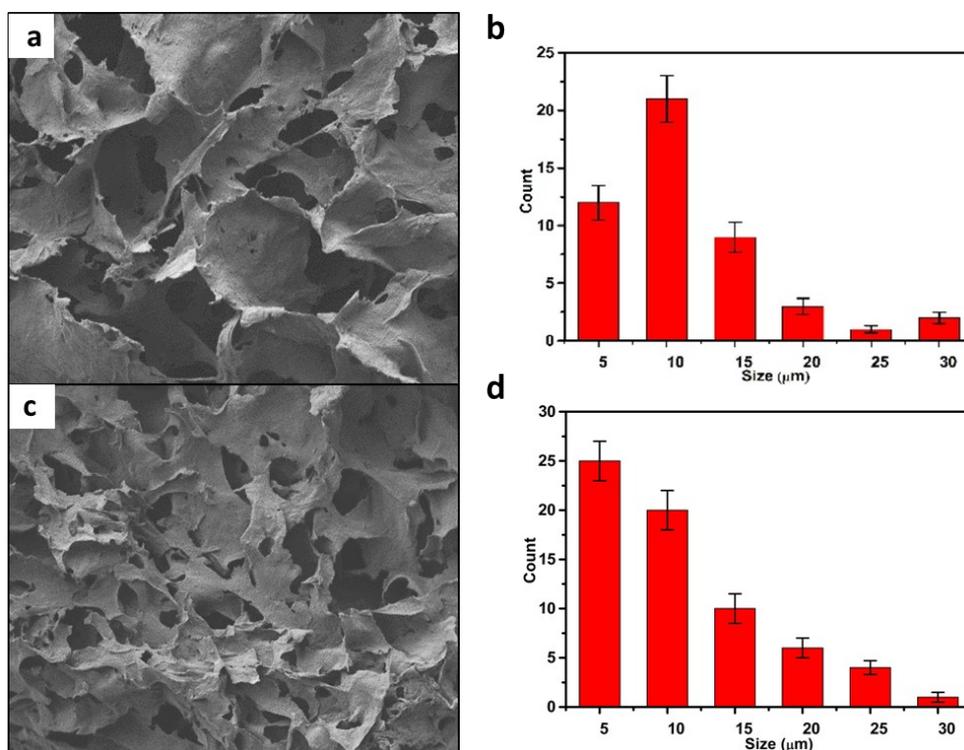
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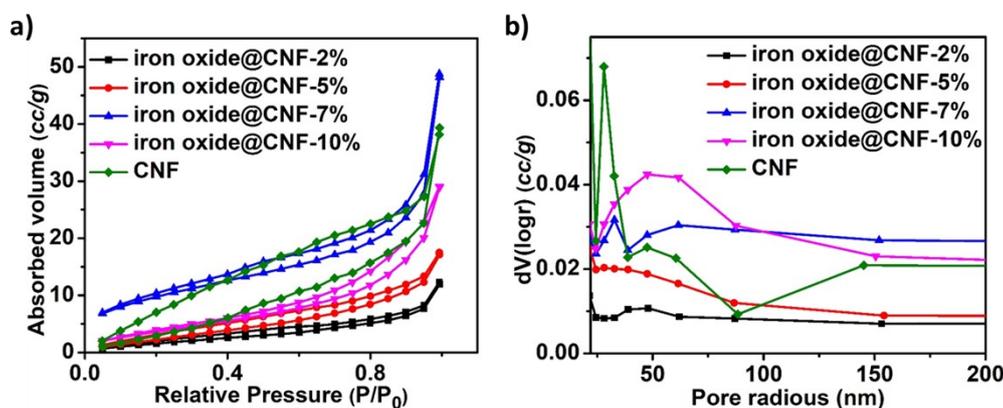


**Fig S6:** Digital image of iron oxide@CNF- 15 and 20% nanohybrids at the time of washing.

**Pore size distribution in CNF aerogel and iron oxide@CNF nanohybrid:**

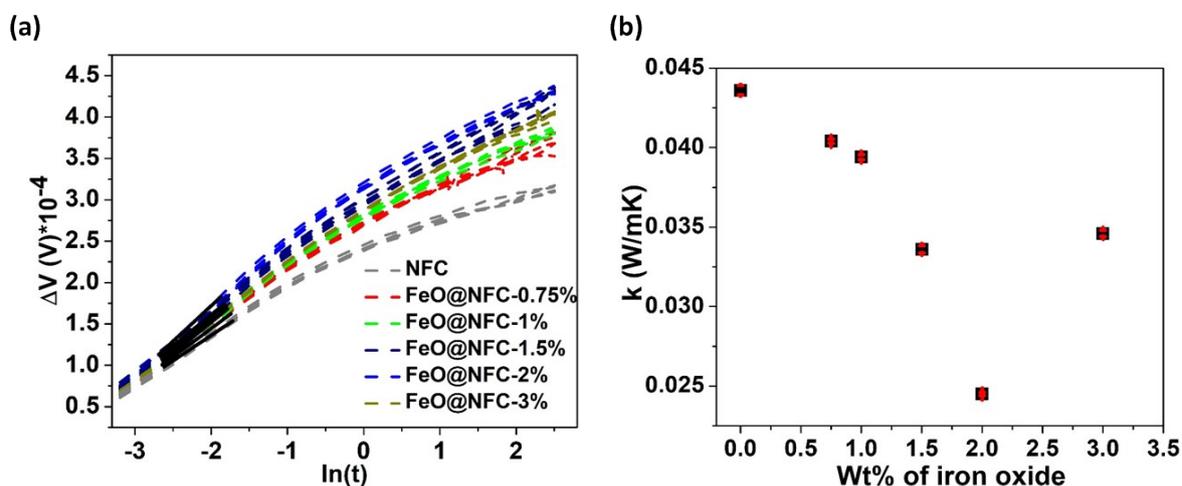


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**Fig. S8:** (a) Nitrogen adsorption and desorption isotherms, and (b) Barrett–Joyner–Halenda (BJH) pore size distribution of CNF and CNF nanohybrids.

#### Thermal conductivity measurement of iron oxide@CNF nanohybrid:



**Fig. S9:** (a) Thermal conductivity measurement of CNF and iron oxide@CNF nanohybrids with different wt % of iron oxide nanoparticles (0.75%, 1%, 1.5%, 2% and 3%) using transient hot wire method and (b) Plot of differential thermal conductivity values of the nanohybrid material with doping of different wt% of iron oxide nanoparticles.

