

# Supporting information

## Nanofibrous photothermal materials from natural resources: a green approach for artwork restoration

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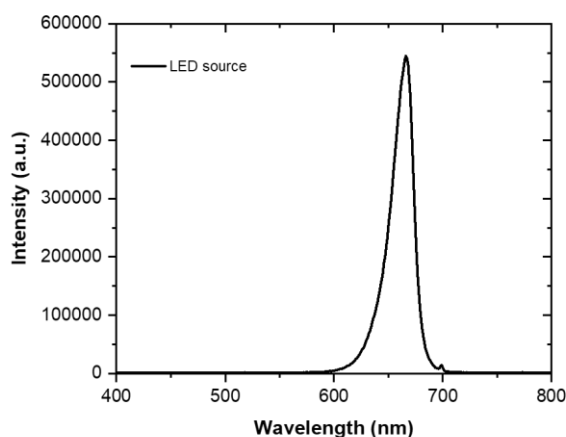
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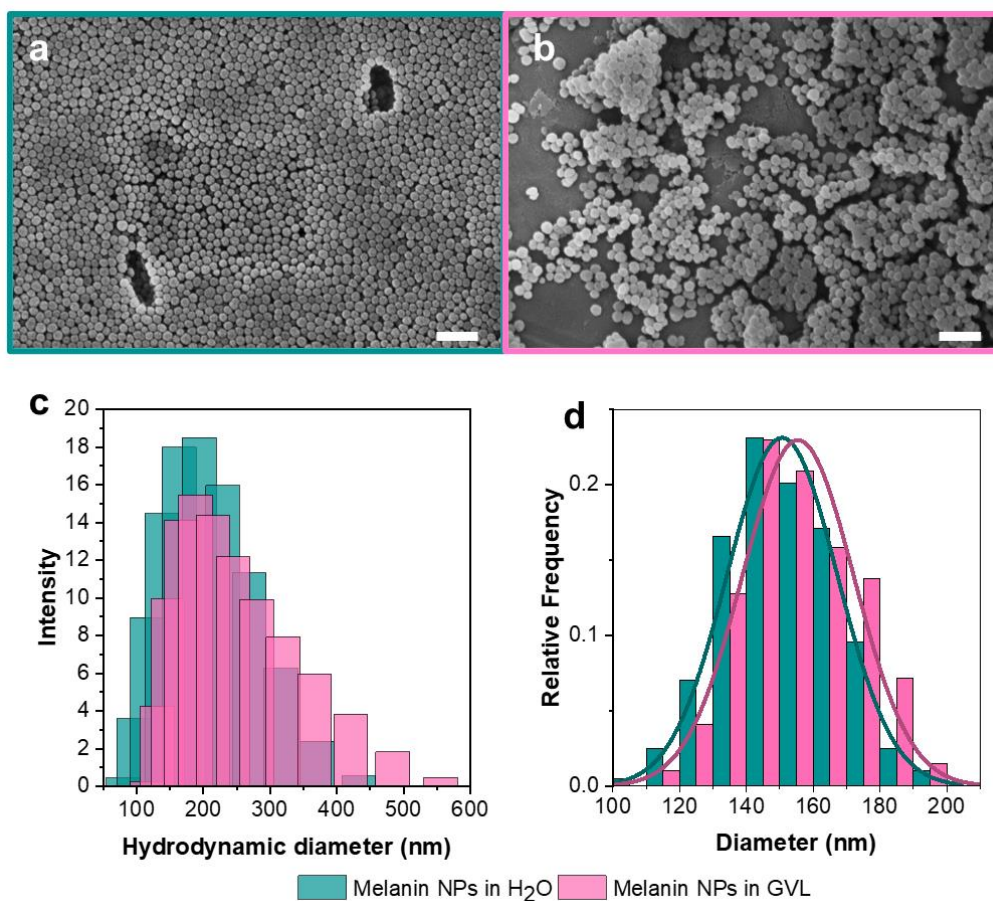
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## 1. Emission light of the LED source



**Figure S1.** Emission spectrum of the LED source (660 nm) used for irradiation.

## 2. Characterization of melanin NPs

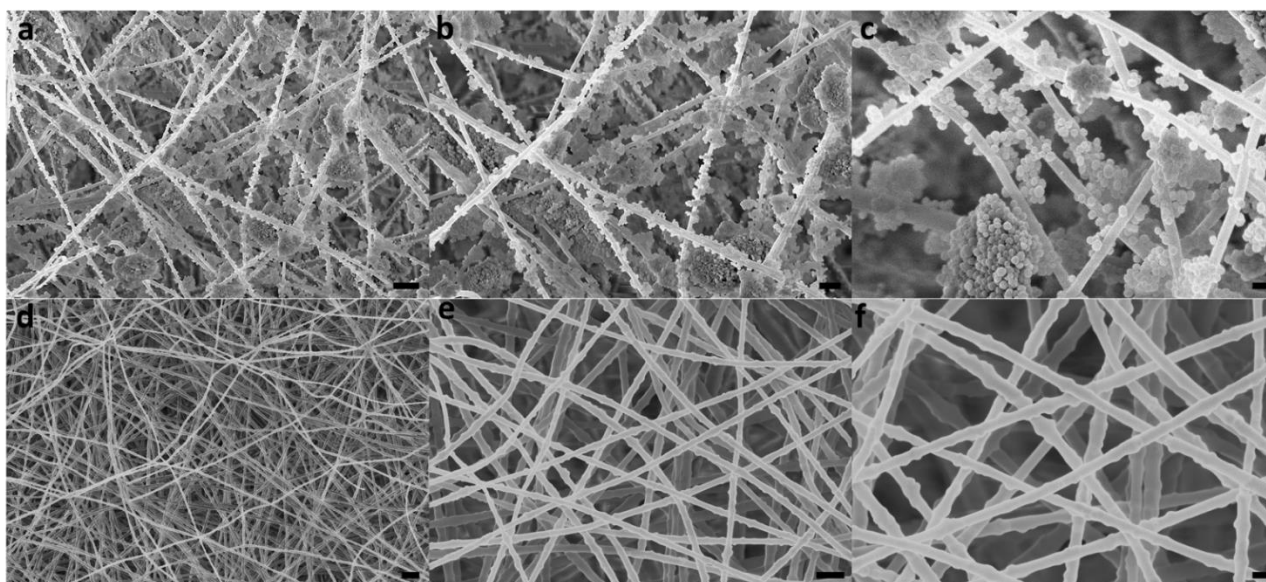


**Figure S2.** SEM micrographs (scale bar = 600 nm) of melanin NPs obtained from dispersions in water (a) and GVL (b). (c) Hydrodynamic diameter distribution of melanin NPs dispersions in water (pink) and GVL (green), obtained by DLS analysis. (d) Diameter distribution of melanin NPs in water (pink) and GVL (green) obtained by SEM images.

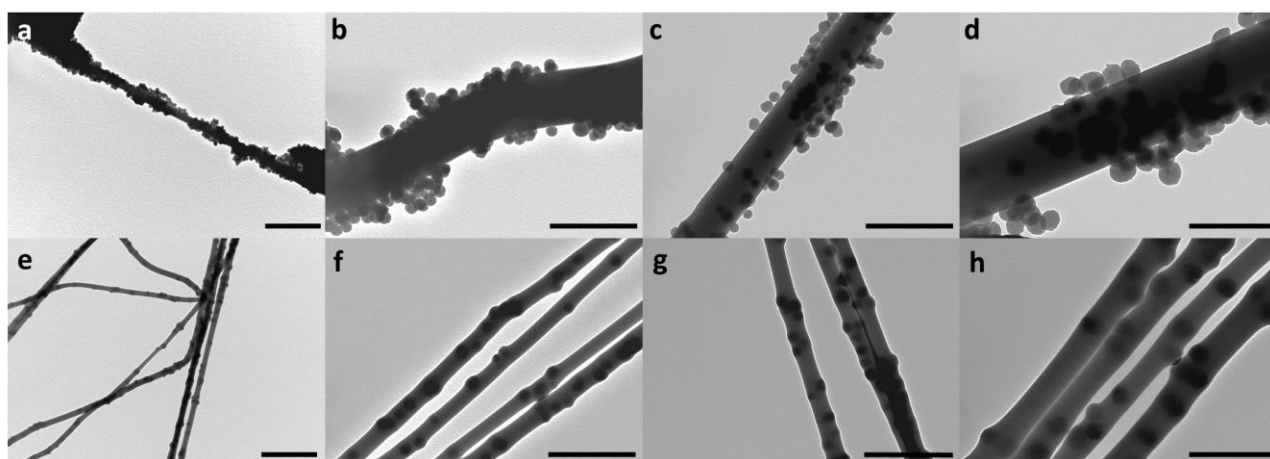
**Table S1.** Diameter distribution of melanin NPs in water and GVL obtained by SEM and DLS.

Melanin NPs dispersion	Diameter by SEM [nm]	Hydrodynamic diameter by DLS [nm]
Water	$151 \pm 17$	205 (PDI 0.08)
GVL	$155 \pm 17$	281 (PDI 0.5)

### 3. Morphological characterization of electrospun non-wovens



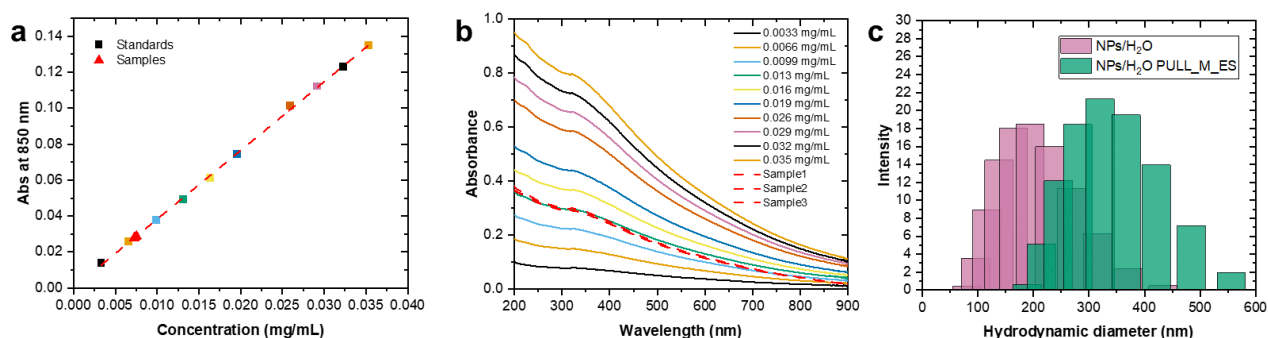
**Figure S3.** SEM images of PULL\_M\_C (a-c) and PULL\_M\_ES (d-f). Scale bar: 2  $\mu\text{m}$  (a and d); 1  $\mu\text{m}$  (b and e); 400 nm (c and f).



**Figure S4.** TEM images of PULL\_M\_C (a-d) and PULL\_M\_ES (e-h). Scale bar: 2  $\mu\text{m}$  (a and e); 1  $\mu\text{m}$  (b, c, f and g); 500 nm (d and h).

#### 4. Melanin quantification in the pullulan nanofibres (PULL\_M\_ES)

A calibration curve (Figure S5a) was obtained by measuring the absorption spectra of melanin dispersions in water at known concentrations and considering their absorbance at 850 nm (Figure S5b). This wavelength was chosen to minimize the different scattering contributions to the absorption spectra of the melanin dispersions used for the calibration curve and the melanin dispersions obtained after the solubilization of PULL\_M\_ES. Indeed, DLS analysis revealed that the melanin NPs dispersed in water have a mean diameter of 200 nm, whereas, in the dispersion obtained after the solubilization of PULL\_M\_ES, particles have a larger mean diameter (290 nm) (Figure S5c), probably due to a higher aggregation they have in the mat. This difference in size, being Rayleigh scattering directly correlated to the sixth power of the particle's radius,<sup>1</sup> leads to different scattering signals in the absorption spectra. Due to the inverse proportionality of Rayleigh scattering and wavelength,<sup>1</sup> at large wavelengths, as 850 nm, the scattering contribution is neglectable with respect to the absorbance of melanin, making possible its quantification based on the calibration curve.



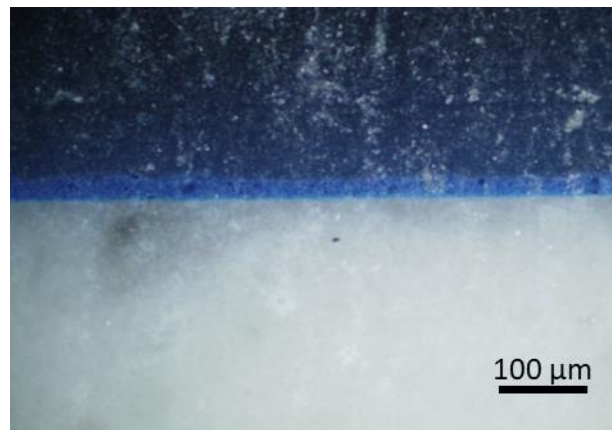
**Figure S5:** Calibration curve (a) and absorption spectra (b) for calculating the amount of melanin NPs embedded in PULL\_M\_ES. (c) DLS analysis of melanin NPs water dispersion and melanin NPs water dispersion after PULL\_M\_ES dissolution.

#### 5. Photothermal characterization of PULL\_M\_ES

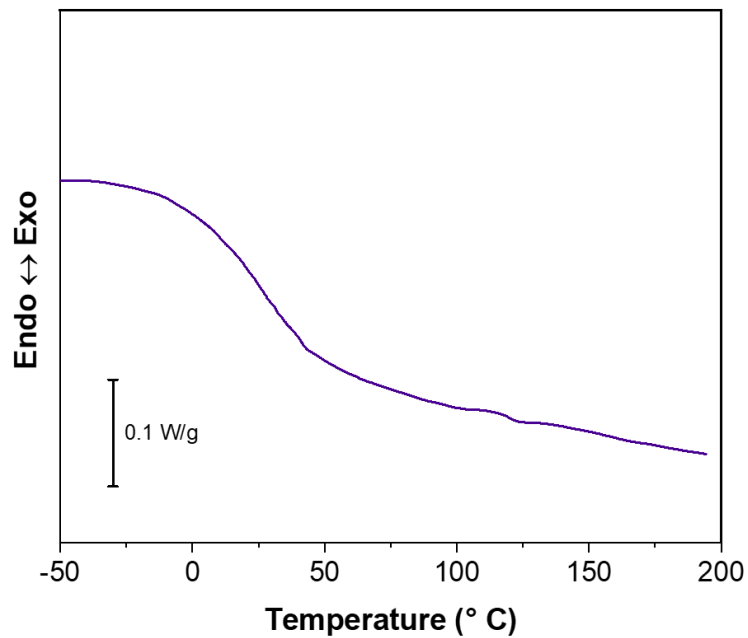
**Table S2.** PULL\_M\_ES was irradiated by the LED source at four different irradiances, and the temperature was monitored over time on both the front and back sides of the sample. Average plateau temperature reached at different irradiances on five cycles of irradiation.

Irradiance [W/m <sup>2</sup> ]	Front side temperature [°C]	Back side temperature [°C]
223	49.1 ± 0.5	46.9 ± 0.2
453	74.3 ± 0.2	69.1 ± 0.3
648	97.8 ± 0.5	89.9 ± 0.2
858	118.6 ± 0.5	108.8 ± 0.4

## 6. Cleaning tests



**Figure S6.** Optical microscope micrograph (20x) of the mock-up cross-section embedded in resin.



**Figure S7.** DSC first heating scan of the alkyd resin after curing for 48 h at 70 °C.

## 7. References

(1) Potter, K. S.; Simmons, J. H. Chapter 3 - Optical properties of insulators-fundamentals. In *Optical Materials (Second Edition)*, Potter, K. S., Simmons, J. H. Eds.; Elsevier, **2021**; pp 101-171.