

Supporting Information

Biomass-derived solar-to-thermal materials: promising energy absorbers to convert light to mechanical motion

Xiongfei Luo, Chunhui Ma, Zhijun Chen,* Xinyue Zhang, Na Niu, Jian Li, Shouxin

Liu and Shujun Li*

Key Laboratory of Bio-based Material Science and Technology of Ministry of
Education, Northeast Forestry University, Hexing Road 26, Harbin 150040, P.R.
China.

*E-mail address: chenzhijun@nefu.edu.cn (Z. Chen), lishujun_1999@126.com (S.
Li).

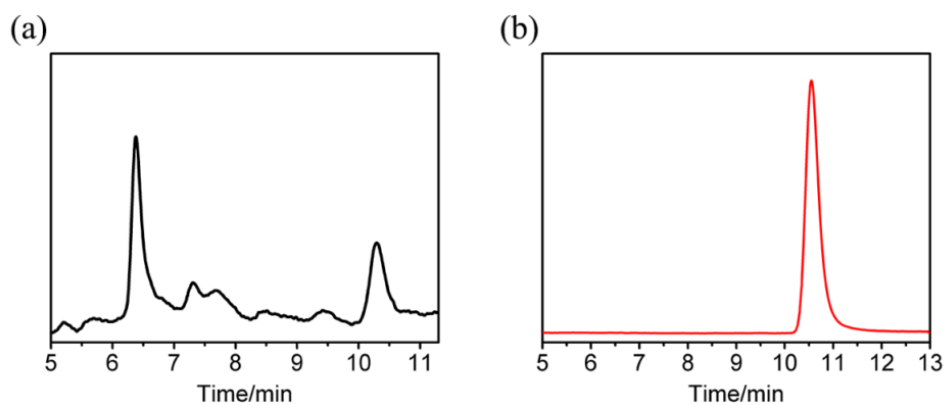


Figure S1. HPLC chromatograms of (a) LBE and (b) catechin

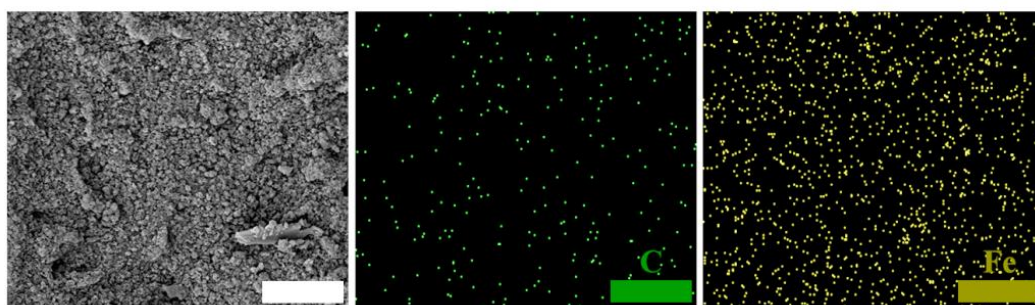


Figure S2. SEM image of LBF (left) and elemental mapping (middle and right), scale bar = 20 μm



Figure S3. Images of catechin and CF, scale bar = 1 cm

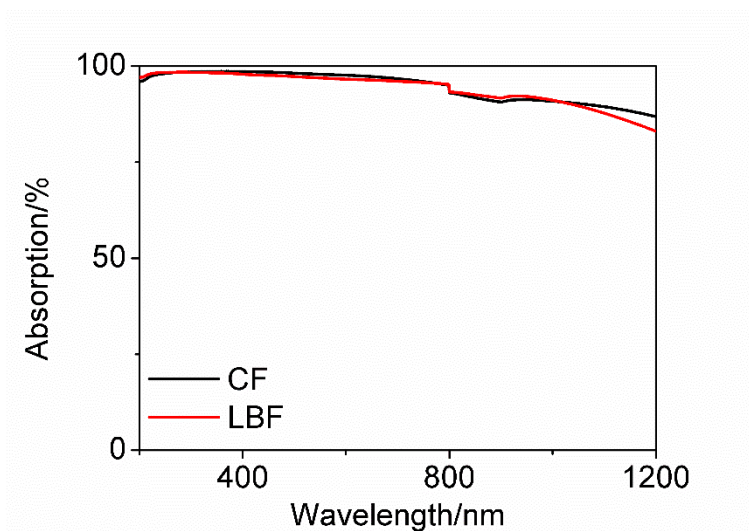


Figure S4. UV-vis-NIR spectra of CF and LBF

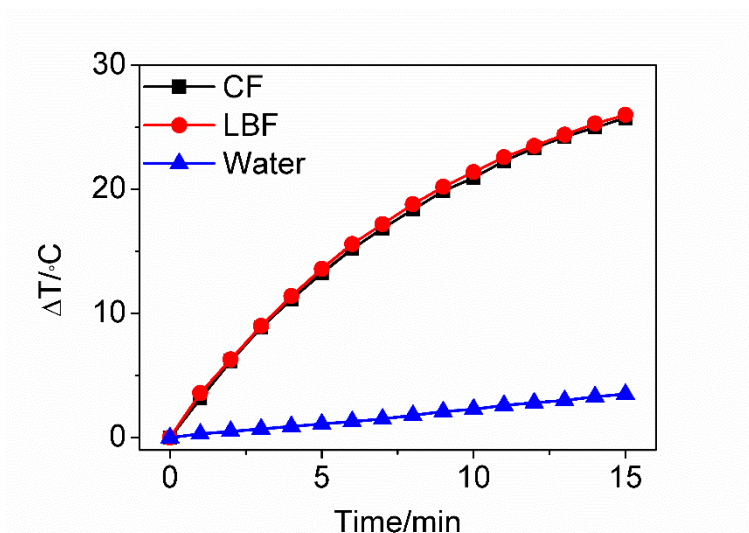


Figure S5. Photothermal heating curves of pure water, LBF and CF (1mg/mL) under standard 1 sun irradiation

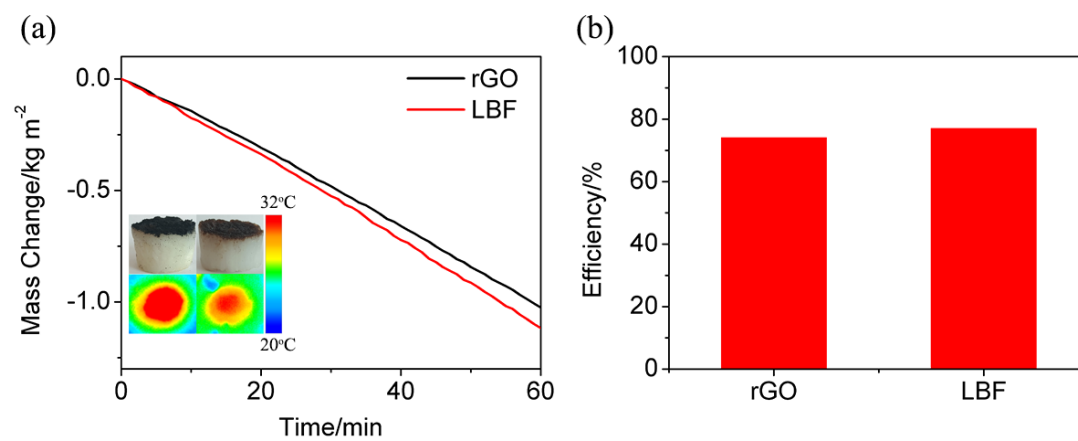


Figure S6. a) Mass change of water over time. Inset: Images of CNF/PVA aerogel

decorated with LBF film (left) and rGO film (right), top; IR mages of CNF/PVA aerogel decorated with LBF film (left) and rGO (right) in the water upon 1 standard solar irradiation, down. b) Efficiency of the floating system decorated with LBF film and rGO film. The evaporation efficiency is given by following equation¹

$$\eta = \frac{\dot{m}h_{LV}}{C_{opt}q_i}$$

Where \dot{m} is the evaporation rate, h_{LV} is the total enthalpy including both sensible heat and phase change of liquid to water, C_{opt} is the optical concentration and q_i is the normal solar irradiation (1kw m^{-2}).

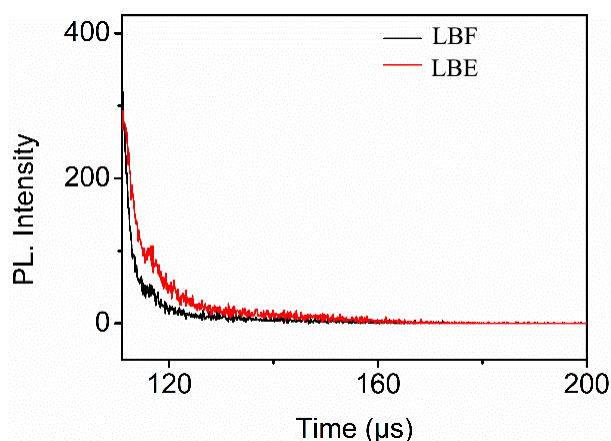


Figure S7. Fluorescence lifetime of LBE and LBF (excitation wavelength = 380 nm).

$$\tau = \frac{1}{k_f + \Sigma k} \quad \text{Equation. S1}$$

$$Y_f = \frac{k_f}{k_f + \Sigma k} \quad \text{Equation. S2}$$

Where τ is the fluorescence lifetime and Y_f is the quantum yield. Values of τ and Y_f were calculated using the radiative constant (k_f) and the non-radiative constant (Σk).

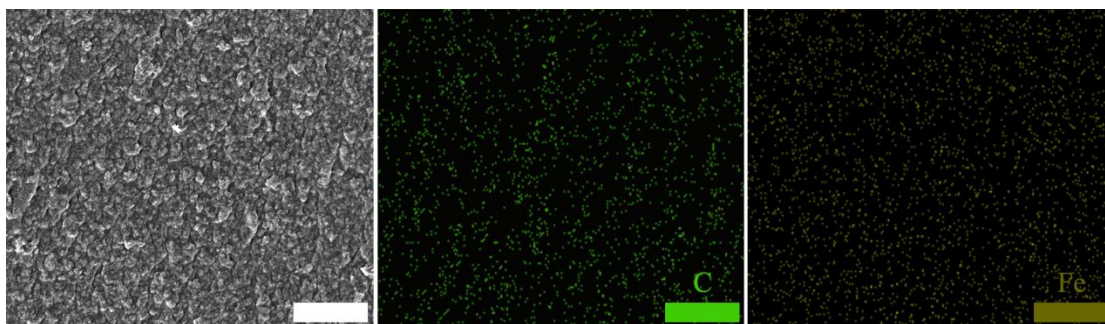


Figure S8. SEM images of 80% LBF/PVA film (left) and elemental mapping (middle and right), scale bar = 50 μm

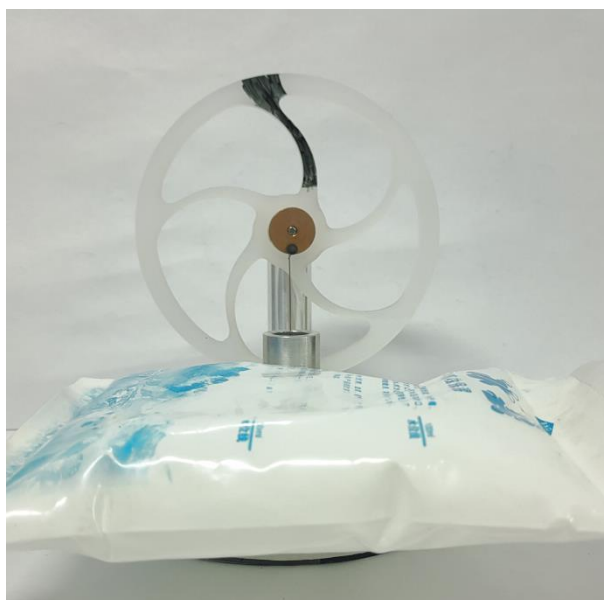


Figure S9. Images of Stirling engine decorated with LBF/PVA composite film (50% LBF) in the presence of cooling bag.

Video S1. Stirling engine treated with LBF/PVA composite film under irradiation.

Video S2. Stirling engine treated with pure PVA film under irradiation.

References

1. H. Liu, C. Chen, G. Chen, Y. Kuang, X. Zhao, J. Song, C. Jia, X. Xu, E. Hitz and H. Xie, *Adv. Energy Mater.*, 2018, 8, 1701616.