



Life cycle sustainable flame retardant flexible polyurethane foam: a new strategy towards waste minimization

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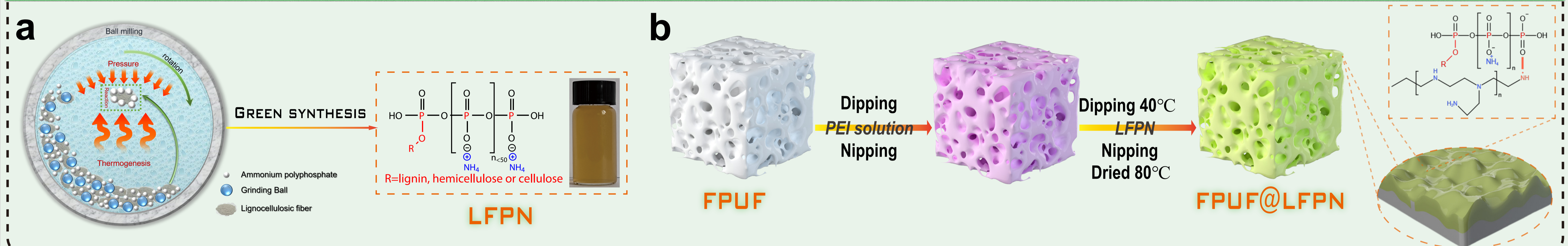
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ABSTRACT

The increasing consumption of flexible polyurethane foam (FPUF) has caused two significant threats: fire hazards and environmental pollution. Here, the novel process to realize the full lifecycle sustainable utilization of flame retardant FPUF was proposed. Firstly, the biobased P-N coating (LFPN) was green synthesized by mechanochemistry, and the FPUF was finished by polyelectrolyte-assisted deposition technology. In order to extend the service life for FPUF, FPUF@LFPN can be reused as a sewage treatment material to remove metal pollution from water. Ultimately, the FPUF@LFPN can be upcycled into high-value products such as metal oxide/carbon composites through the metal catalytic pyrolysis technique. This process can effectively reduce the fire and environmental hazards caused by FPUF and may provide an innovative train of thought for the green and sustainable use of other porous polymer materials.

EXPERIMENTAL



RESULTS & DISCUSSION

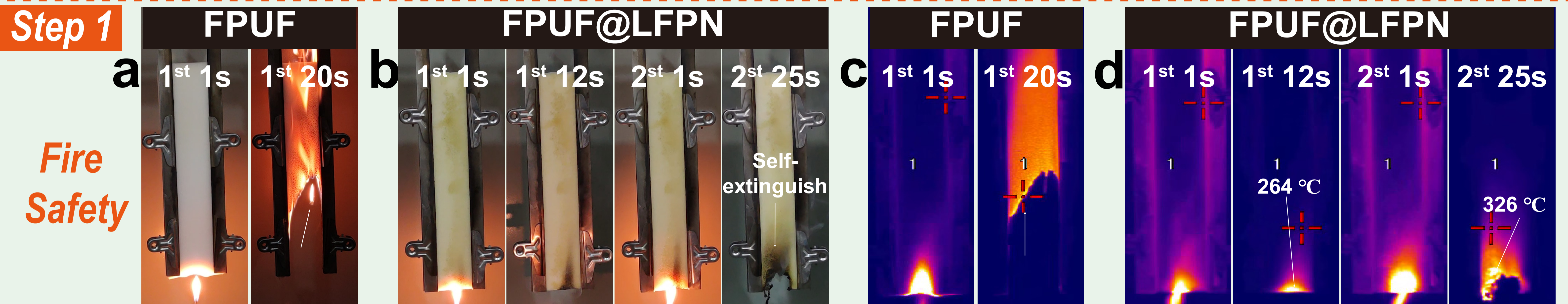


Figure 1. The FPUF@LFPN passed the vertical burning test (according to TB 117-2000). Moreover, the fire performance index of FPUF was improved by 110.6 % after being treated via LFPN. In addition, the compression resistance of FPUF was enhanced without affecting the resilience.

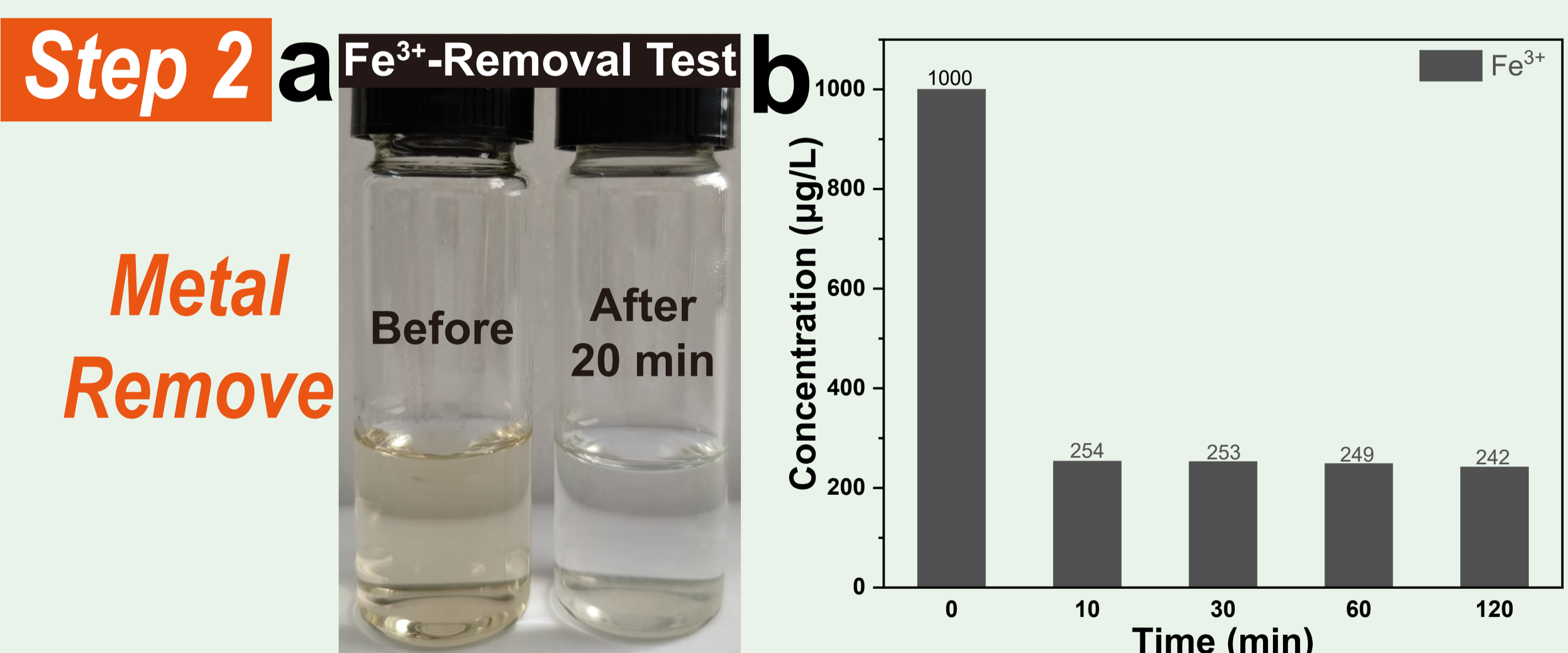


Figure 2. The wasted FPUF@LFPN can be reused as a sewage treatment material to remove metal pollution from the wastewater. The results showed that FPUF@LFPN could remove 75.8% of Fe³⁺ from water.

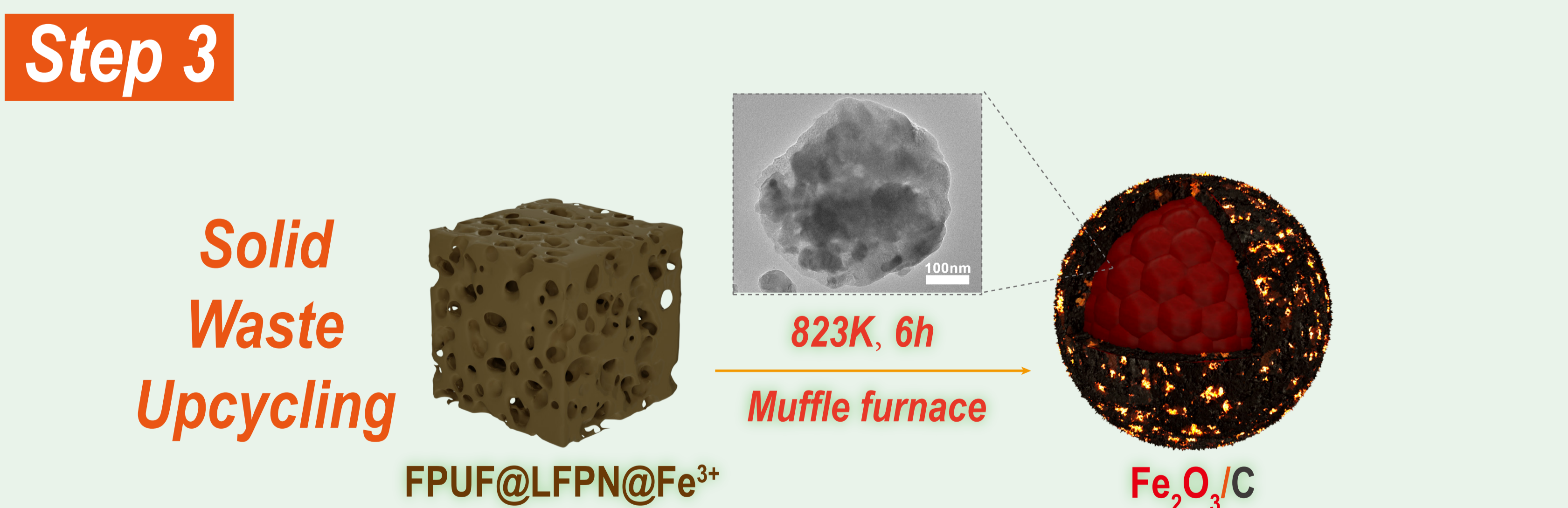


Figure 3. The waste FPUF@LFPN can be upcycled to high-value metal oxide/carbon composites, realizing the full lifecycle sustainable utilization of flame-retardant flexible polyurethane foam.

Life cycle sustainable processes for FPUF

CONCLUSION

This work showed the great potential of flame-retardant finishing, multi-stage utilization, and upcycling for FPUF by functional wood fiber bio-based nano-coating.