Electronic supplementary information (ESI†):

Flame retardant lignin-based silicone composites

*Jianfeng Zhang,[a] Etienne Fleury,[b] Yang Chen,[a] and Michael A. Brook[a]**

[a] Chemistry and Chemical Biology, McMaster University, 1280 Main St. W., Hamilton, Ontario, Canada L8S 4M1. Fax: +1-(905) 522-2509; Tel: +1-(905) 525-9140 ext. 23483; E-mail: mabrook@mcmaster.ca

[b] Université de Lyon, CNRS, UMR 5223, INSA-Lyon, IMP@INSA, F-69621, Villeurbanne, France. Fax: +33-472-438-527; E-mail: etienne.fleury@insa-lyon.fr

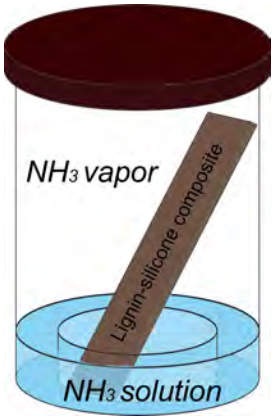

Figure S1. Illustration of the container used for chemical post-treatment using NH_3 vapor. The lignin-silicone composite was exposed to NH_3 vapor without contacting the solution.

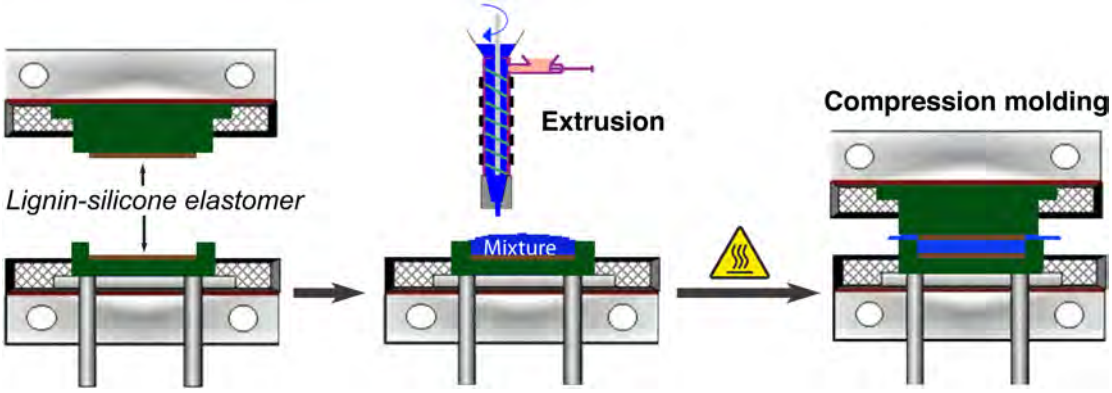

Figure S2. Procedure for making the "sandwich" structured composite. Two pieces of pre-fabricated lignin-silicone elastomer were attached to the top and bottom inner walls of mold prior to injection of the foam.

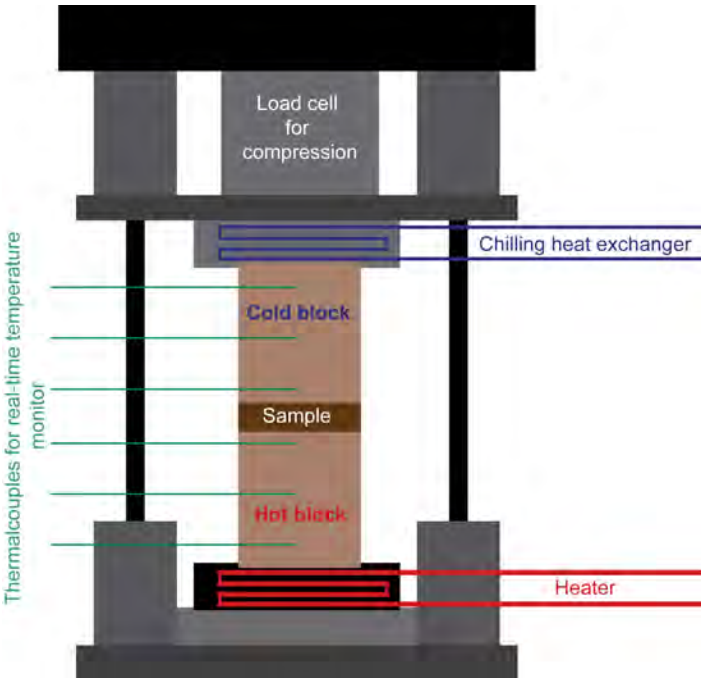

Figure S3. Illustration of the instrument used for the thermal conductivity test.

Equation for thermal conductivity calculation:

$$k = \frac{Q_{sample}}{A \times \left({}^{dT}/_{dx}\right)}$$

where k is the thermal conductivity of the tested sample, Q is the heat transferred from the hot to cold block (without considering the heat loss to surrounding, $Q_{sample} = Q_{hot} = Q_{cold} = 1/2\ (\ Q_{hot} + Q_{cold})$), A is the area of sample, dT is the temperature difference of cold and hot block, dx is the distance of two blocks and equal to the thickness of sample.

Figure S4. Lignin particles before and after modification with PMDS: left is raw lignin, which could be dispersed in water; right is PMDS-modified lignin, which is more hydrophobic and immiscible with water.

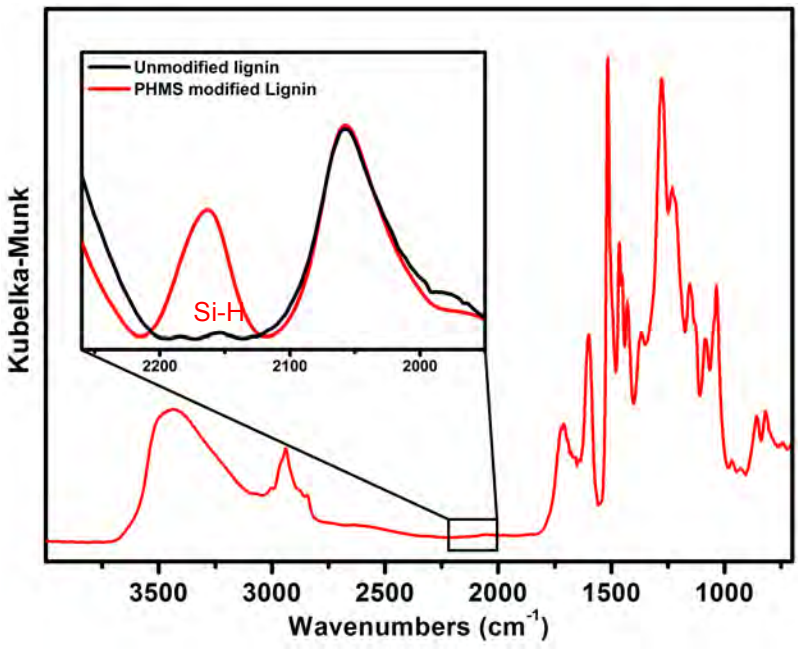

Figure S5. DRIFT-IR spectra of lignin before and after modification with PHMS, Si-H band presents ~2150 cm^{-1}.

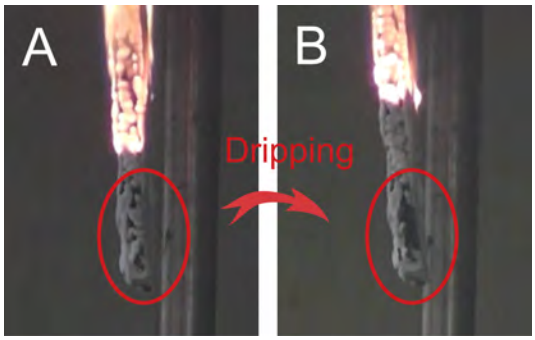

Figure S6. Dripping of lignin-silicone composites during combustion. The residual burst apart from sample, from (A) to (B), exposing the inner black char (B).

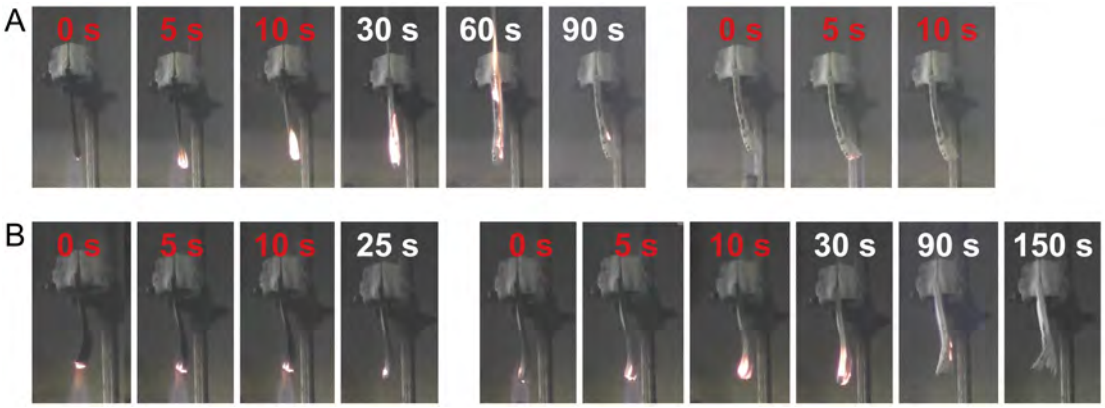

Figure S7. Combustion of lignin-silicone foams (A: F-41C; and B: F-41E).

Figure S8. Sample F-41A (A) and F-41D (B) after combustion, (C) silica shell coating the sample after burning.

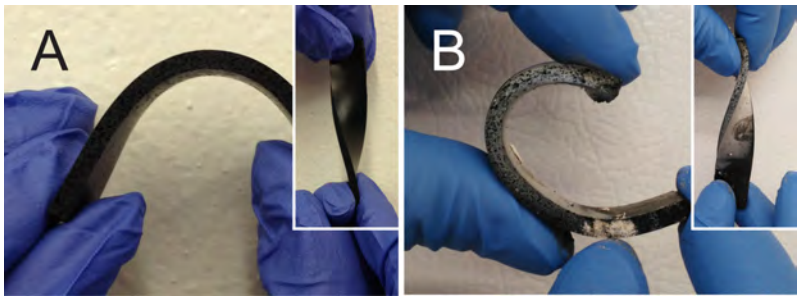

Figure S9. Sample F-41D before (A) and after (B) the combustion test; bending and twisting were applied to test the flexibility.

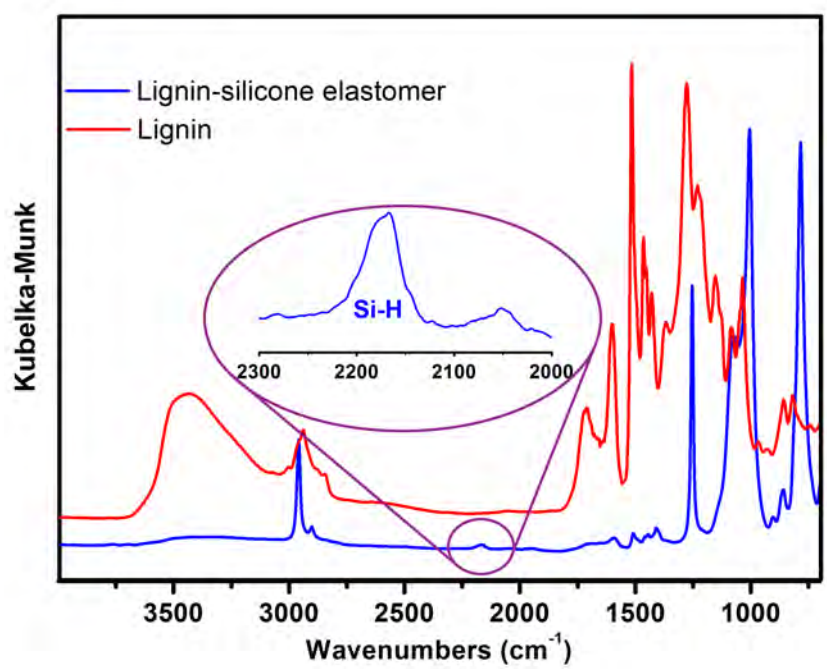

Figure S10. ATR-FTIR spectrum for the lignin-silicone elastomer and lignin, residual Si-H was detected at the surface in the former case.