**Supplementary materials**

# Sm/Co Magnetic Materials: A Recycling Strategy Using Modifiable Hydrophobic Deep Eutectic Solvents Based on Trioctylphosphine Oxide

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**Table S1.** Materials

| Compound | Supplier | CAS | Purity, wt%* |
|---|---|---|---|
| Trioctylphosphine oxide | Acros | 78-50-2 | 98% |
| Thymol | Acros | 89-83-8 | 99% |
| Phenol | Chimmed | 108-95-2 | 99% |
| p-tert-Butylphenol | Chimmed | 98-54-4 | 99% |
| $HNO_3$ | Chimmed | 7697-37-2 | – |
| $Sm(NO_3)_3 \cdot 6H_2O$ | Chimmed | 13759-83-6 | 99% |
| $Co(NO_3)_2 \cdot 6H_2O$ | Chimmed | 10026-22-9 | 99% |
| $NaNO_3$ | Chimmed | 7631-99-4 | 99% |

*Declared by suppliers.

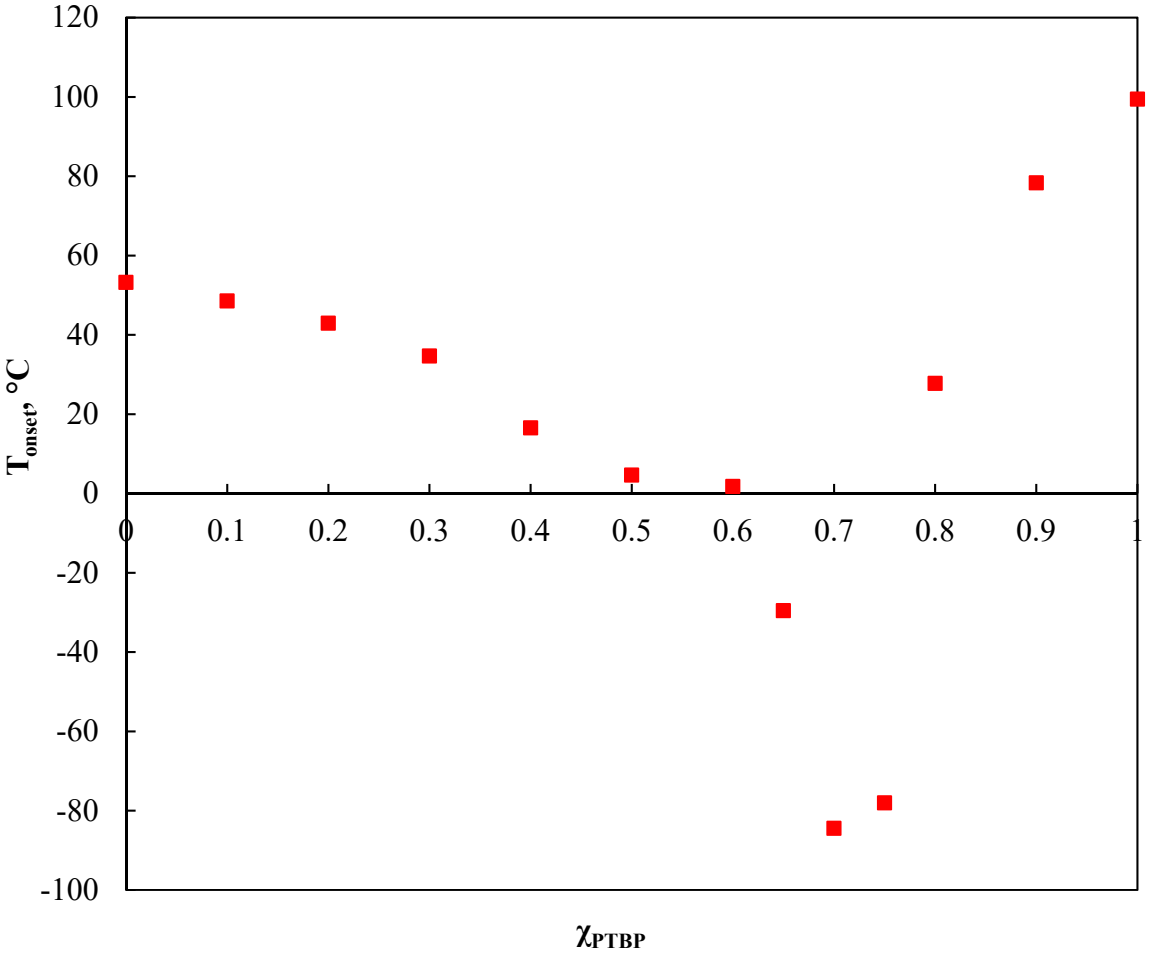


**Figure S1**. Phase diagram for PTBP:TOPO mixture, constructed from DSC results.

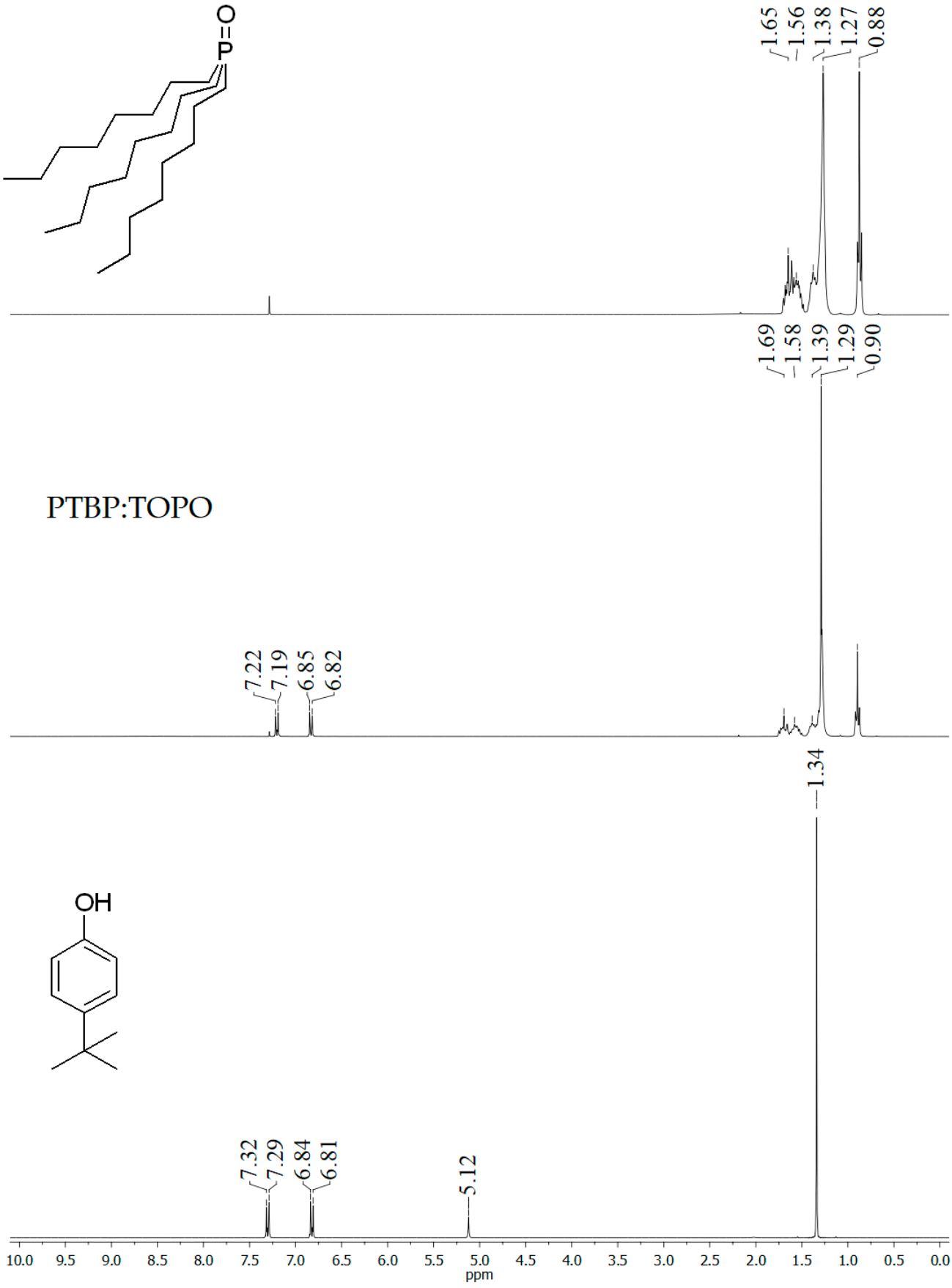


**Figure S2.** Proton NMR of PTBP:TOPO HDES.

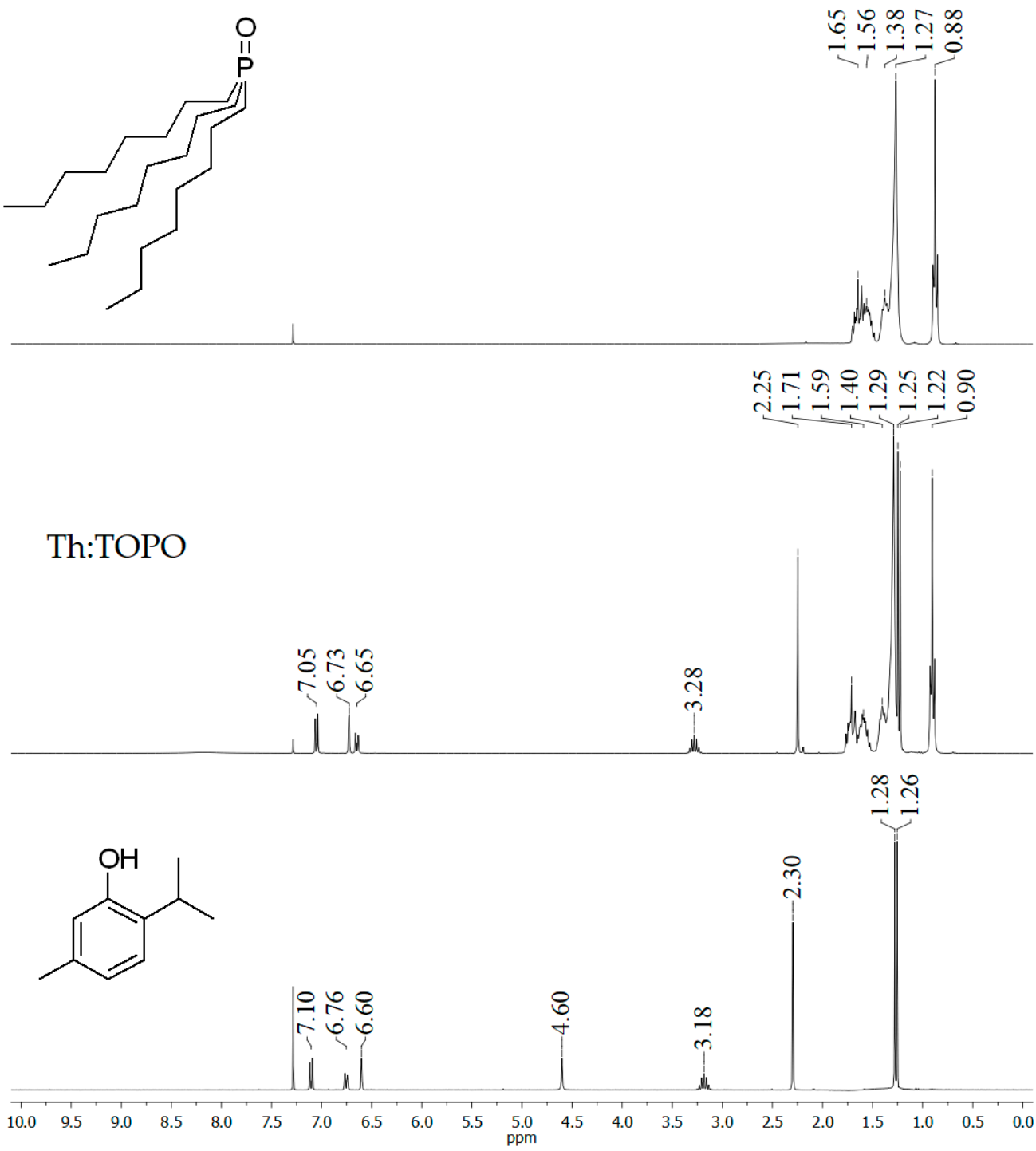


**Figure S3.** Proton NMR of Th:TOPO HDES.

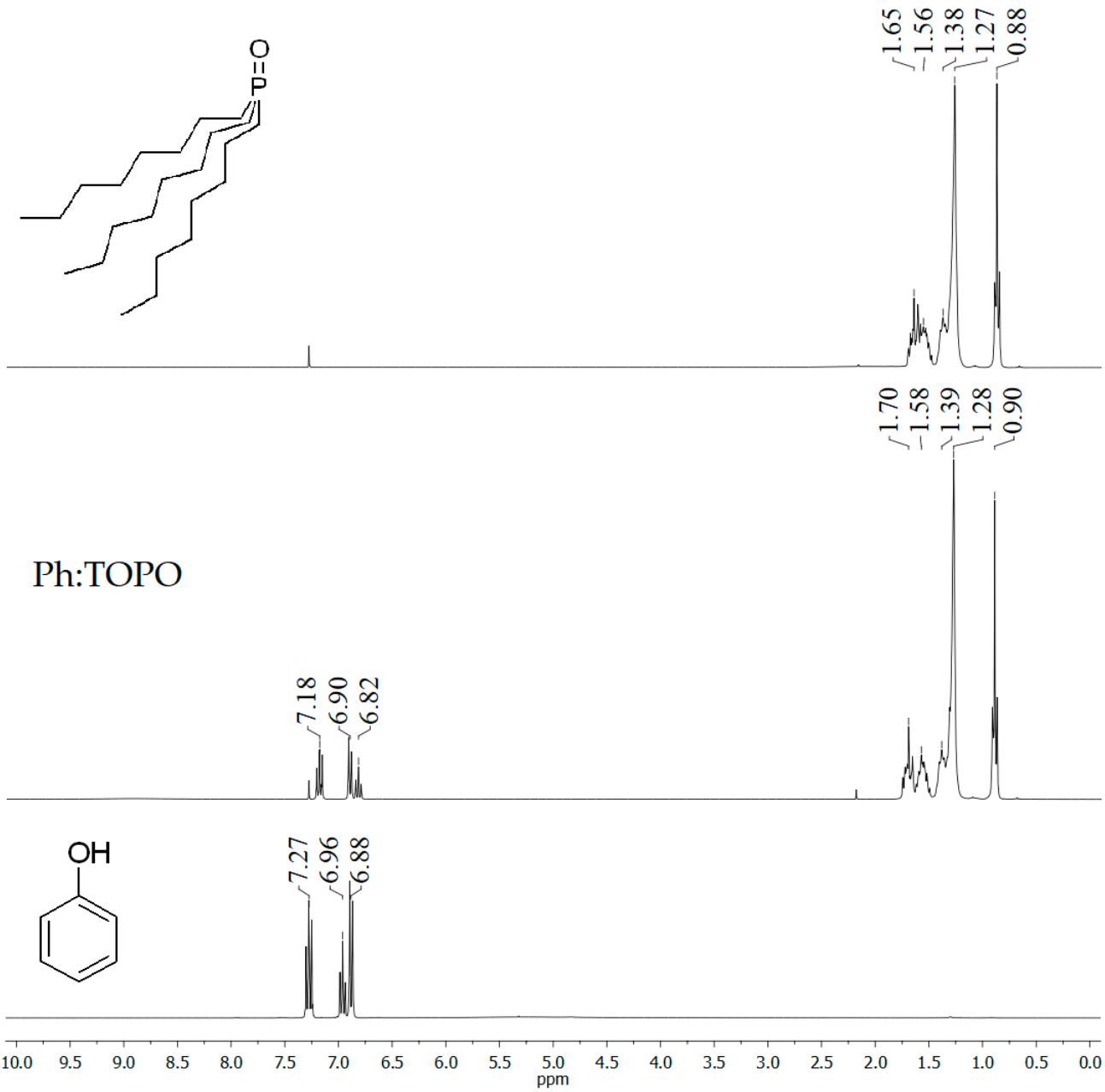


**Figure S4.** Proton NMR of Ph:TOPO HDES.

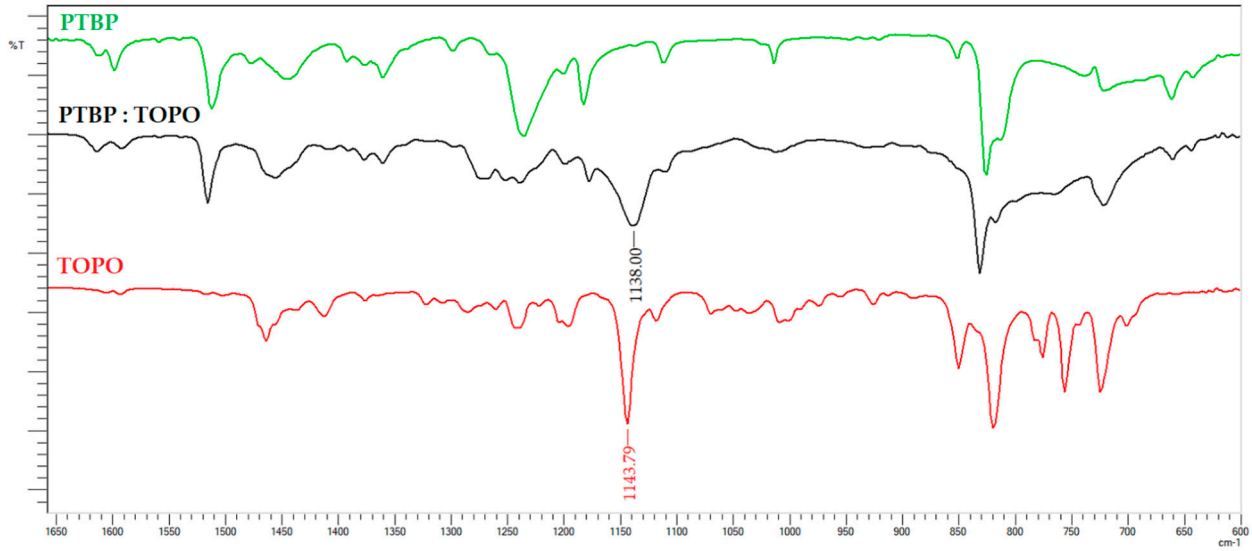


**Figure S5.** FTIR spectra of PTBP:TOPO HDES.

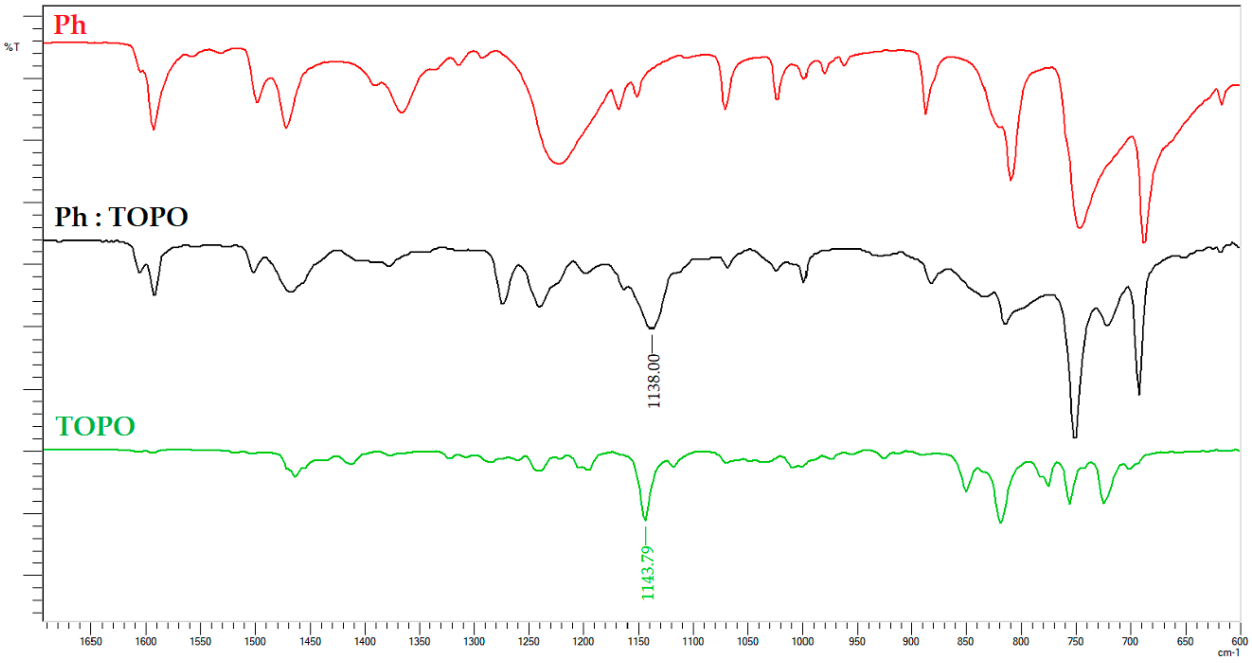


**Figure S6.** FTIR spectra of Ph:TOPO HDES.

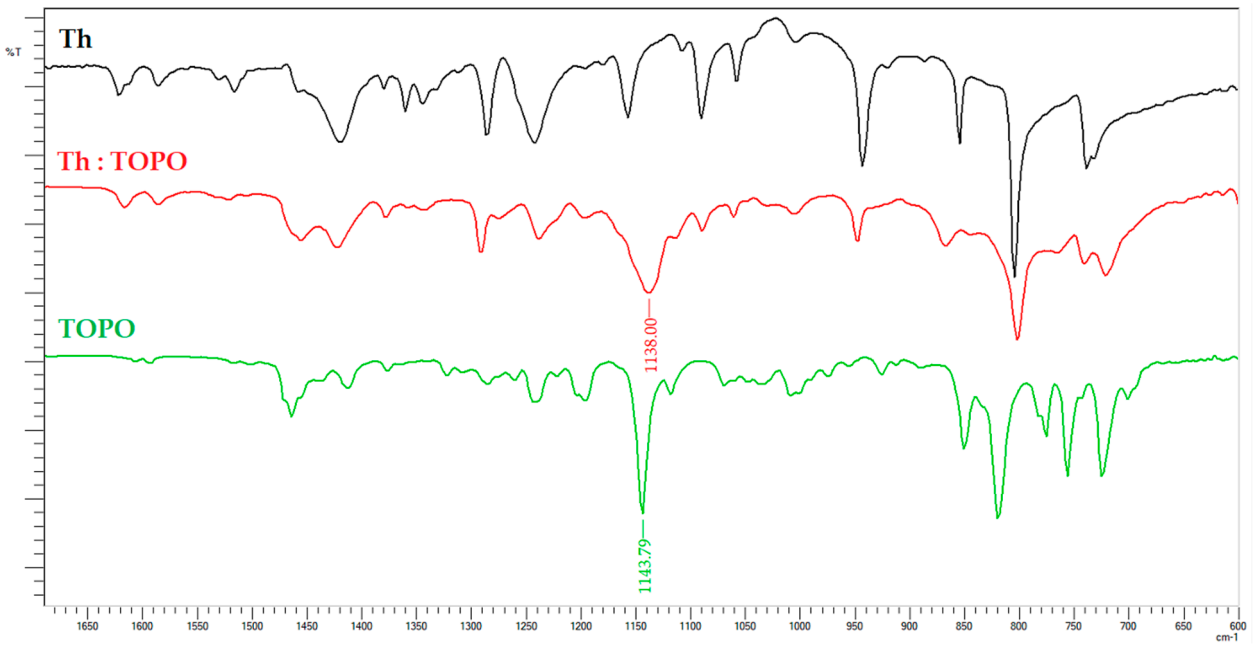


**Figure S7.** FTIR spectra of Th:TOPO HDES.

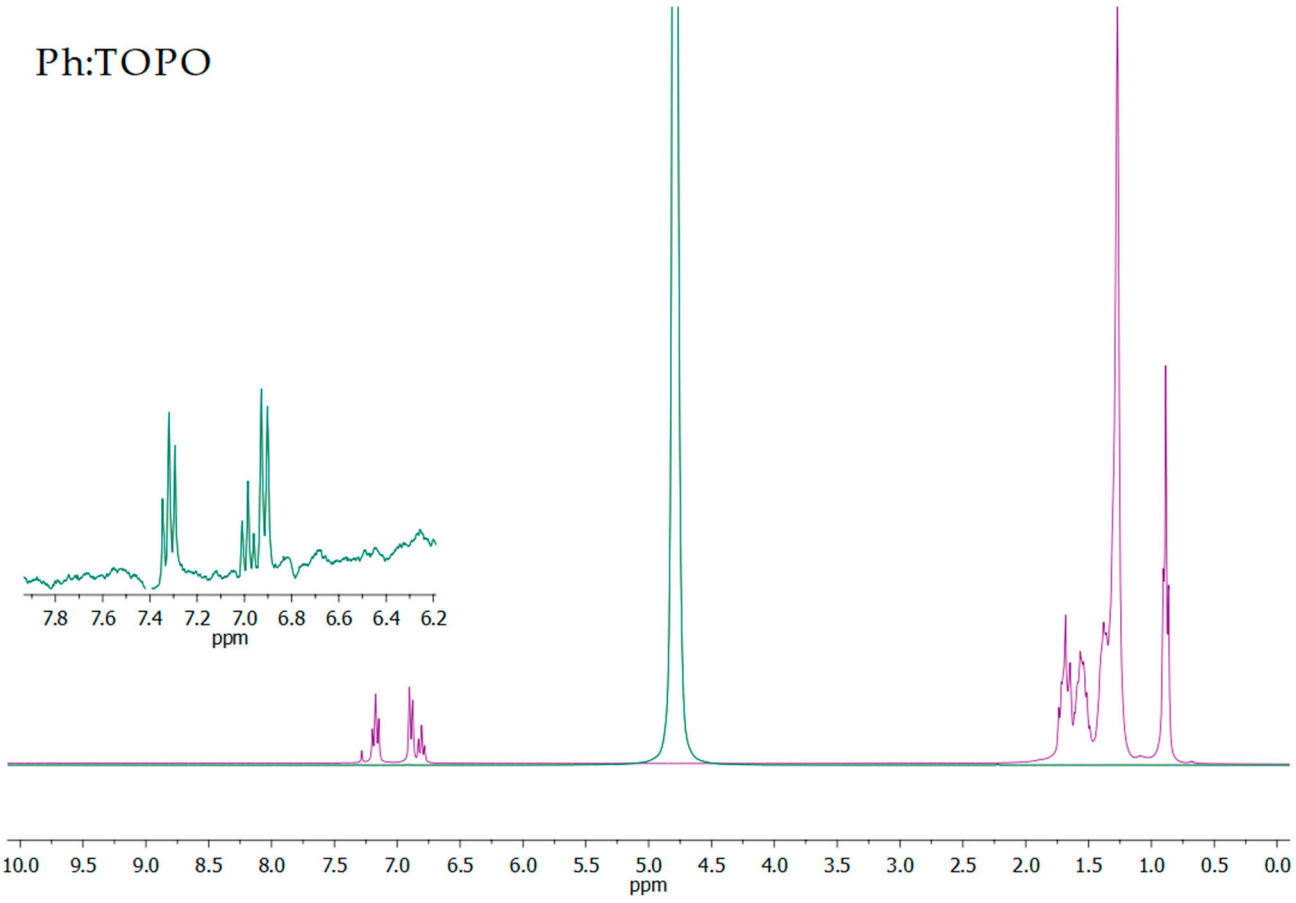


**Figure S8.** $^{1}$H NMR spectra of the aqueous (green line) and HDES Ph:TOPO phases (purple line) after stirring.

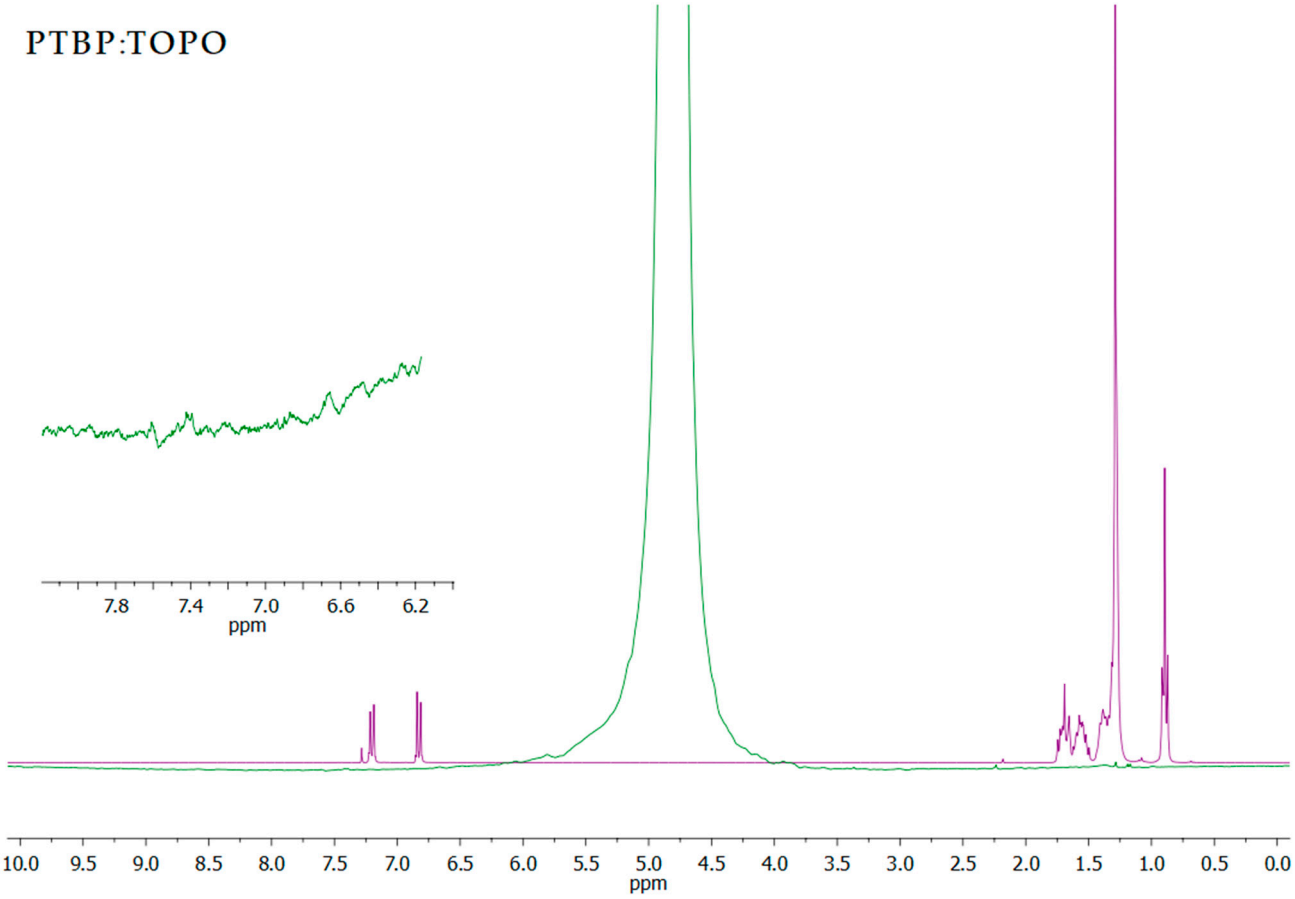


**Figure S9.** $^{1}$H NMR spectra of the aqueous (green line) and HDES PTBP:TOPO phases (purple line) after stirring.

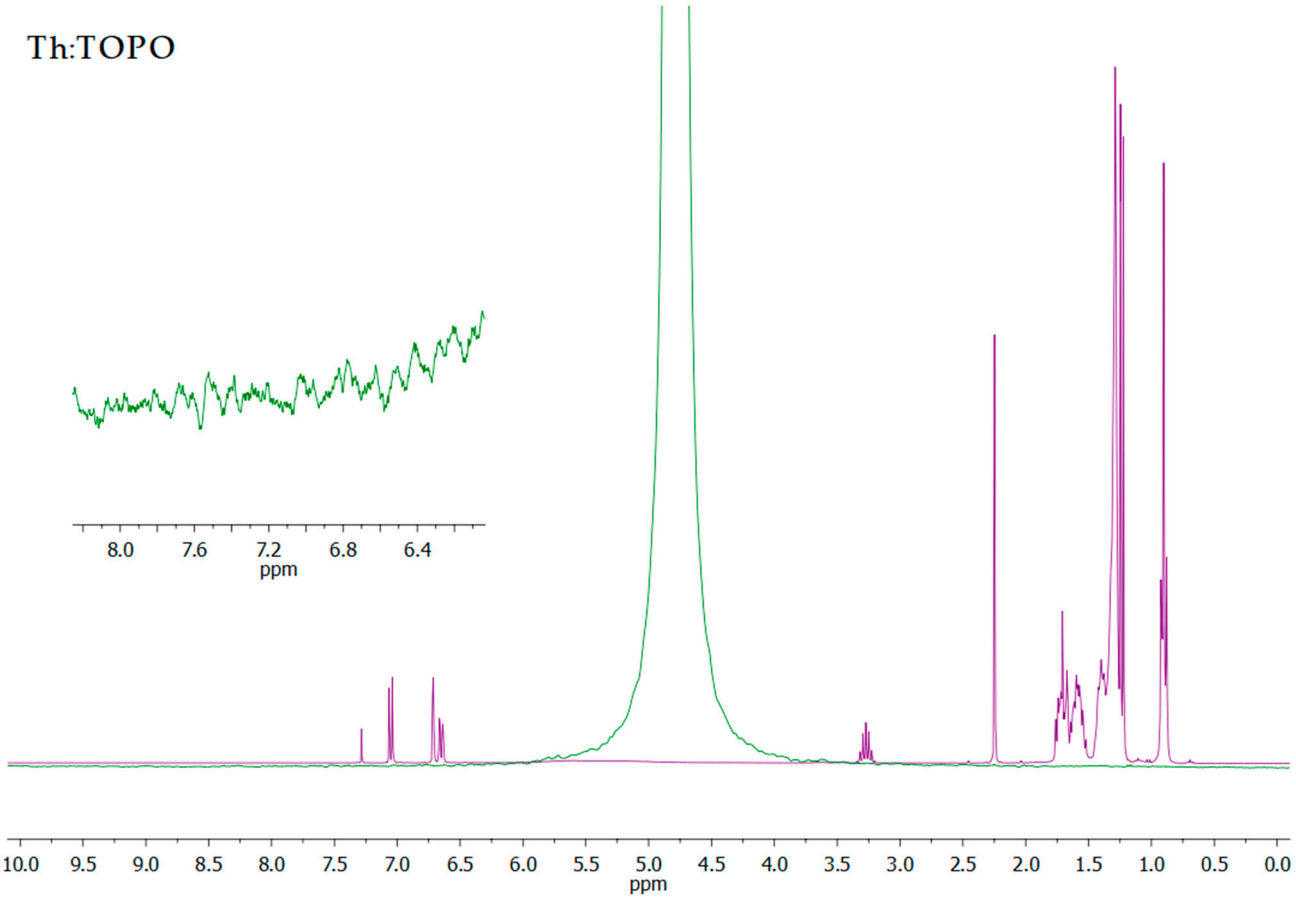


**Figure S10.** $^{1}$H NMR spectra of the aqueous (green line) and HDES Th:TOPO phases (purple line) after stirring.

*Computational study*

Theoretical calculations: optimization of all molecular geometries, NBO (natural bond orbital) charges, supramolecular complexes energies were performed using Gaussian16 [1] software package at PBE-D3(BJ)/def2-TZVP level of theory. PBE [2] functional and Weigend def2-TZVP [3] basis set has recommended itself as a highly accurate method for modelling small organic molecules [4, 5]. Grimme's D3 dispersion correction with Becke–Johnson damping has been used to better estimation of non-covalent interactions [6]. BSSE correction energies computed using the counterpoise scheme [7]. Tight optimization criteria and ultrafine grids were used in each calculation.

## References

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