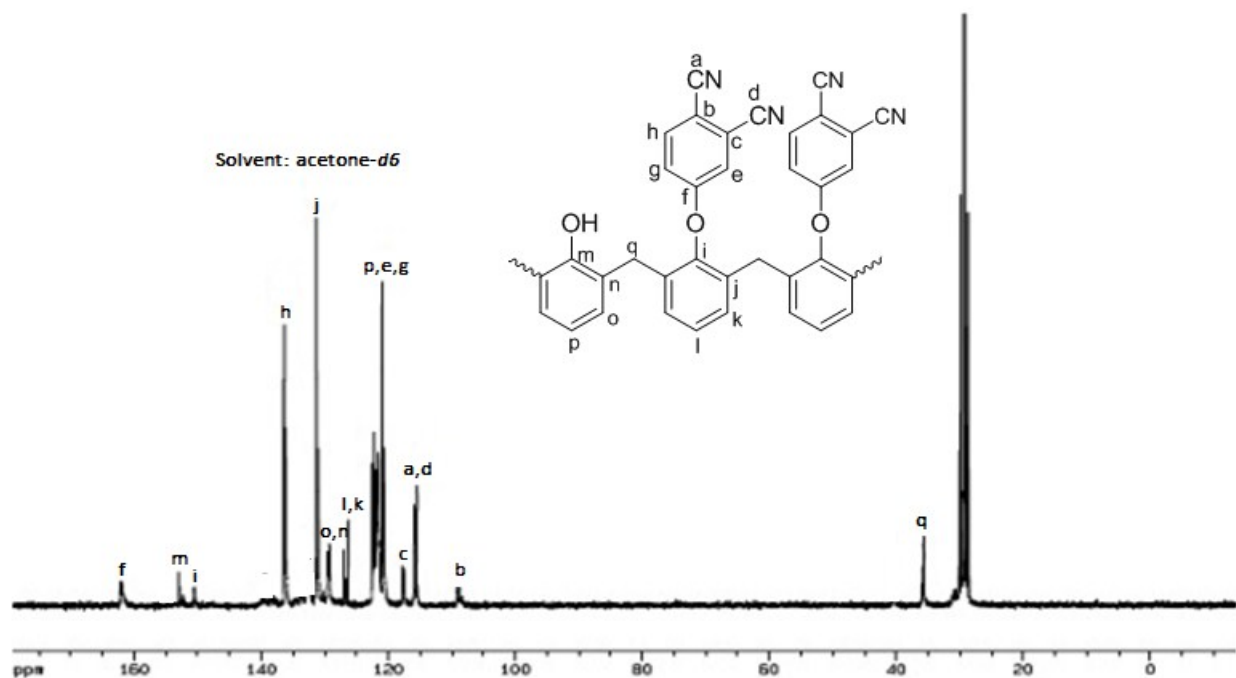
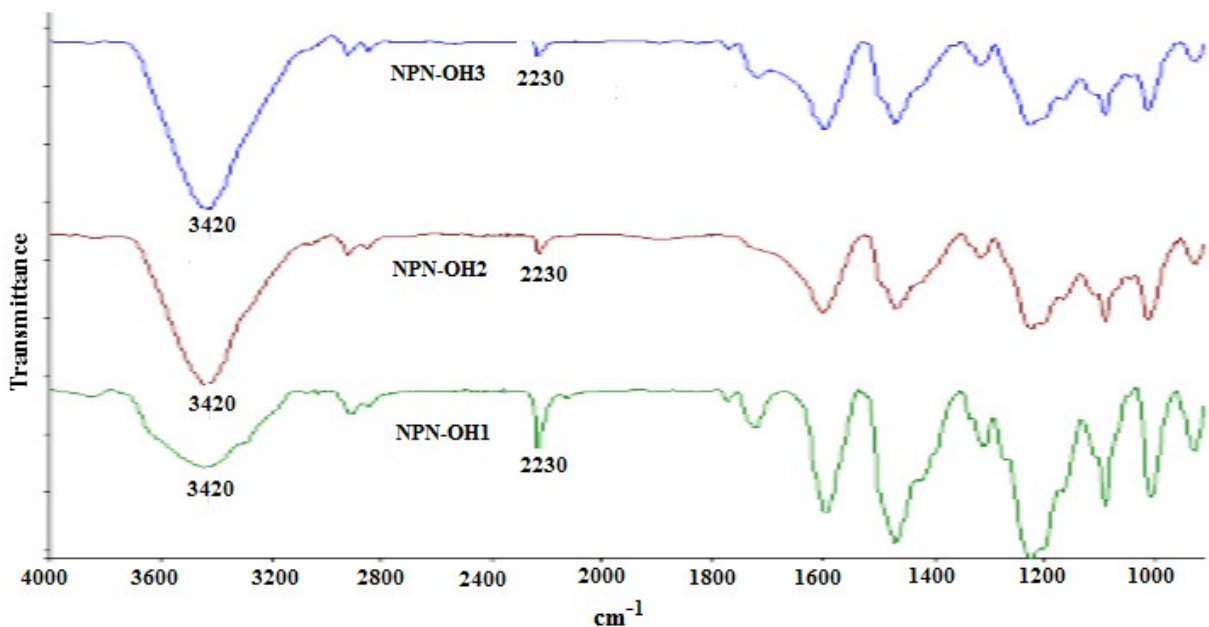


Supplementary information

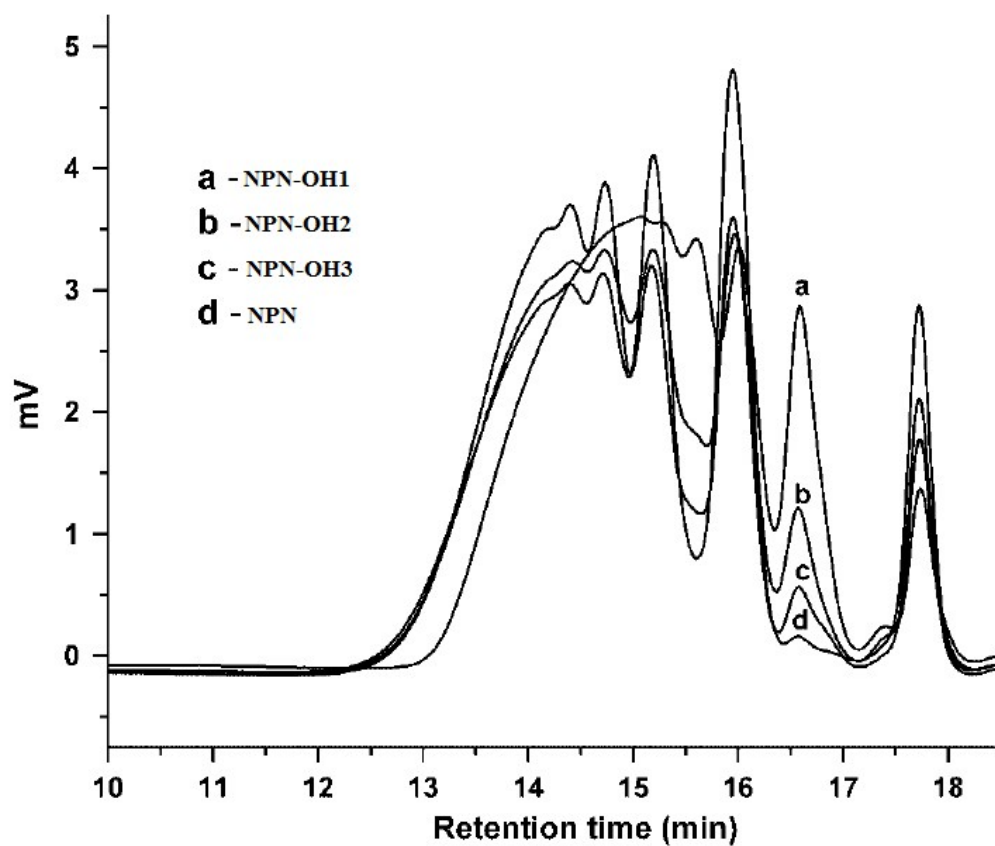
^{13}C spectrum of NPN-OH oligomer



FT-IR spectra of NPN-OH oligomers



GPC of NPN-OH oligomers



Typical calculation for extent of phthalonitration and cyanation in NPN-OCN1 is done as follows :

Nitrogen content for NPN-OH1 (from CHN analysis) = 3 %

Composition of NPN-OH1 can be represented as $[(\text{Ph-CH}_2)\text{OH}]_{(1-x)}(\text{OPN})_x]_n$

Where Ph stands for phenyl and degree of substitution of phenolic OH by phthalonitrile (OPN) group is represented as 'x'

Molecular weight of repeat unit of NPN-OH1 = $91 + 17(1-x) + 143x = 108 + 126x$

Nitrogen fraction = $28x / (108 + 126x) = 0.03$

Solving this, x is obtained as 0.13, i.e degree of phthalonitrile substitution is 13 %

Precursor composition is therefore $[(\text{Ph-CH}_2)\text{OH}]_{0.87}(\text{OPN})_{0.13}]_n$

Upon cyanation, NPN-OH1 is transformed to NPN-OCN1 and the composition of this copolymer can be represented as $[(\text{Ph-CH}_2)(\text{OPN})_{0.13}(\text{OCN})_y\text{OH}_{(0.87-y)}]_n$ where 'y' is degree of cyanation of free -OH groups in NPN-OH1

Nitrogen content for NPN-OCN1 (from CHN analysis) = 11.3 %

Molecular weight of repeat unit of NPN-OCN1 = $91 + 143 \cdot 0.13 + 42y + 17(0.87-y) = 124.38 + 25y$

(Contribution to molecular weight by OCN group is 14y)

Nitrogen content contributed by -OPN groups = 3 %

Therefore, nitrogen content contributed by -OCN groups = $11.3 - 3 = 8.3$ %

i.e $14y / (124.38 + 25y) = 0.083$

Solving this, y is obtained as 0.87. This shows completion of cyanation reaction too

Therefore, in NPN-OCN1, the mole fraction of OPN = 0.13 and that of OCN = 0.87