Supporting Information

Influence of bismuth loading in plastic scintillators for low energy gamma spectroscopy.

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Methods:

Simulation: the energy deposition in a plastic scintillator was simulated using the MCNPX code for different bismuth enrichments (variation from 0 % to 10 % with a step of 1 %). We used an F8 pulse height tally, associated to a GEB function, in order to take the energy resolution of the detector into account. The evolution of the net peak areas was monitored according to the bismuth enrichment for the main gamma-rays emitted at 59.5 keV by ^{241}Am and at 122.1 keV by ^{57}Co.

Emission spectra were recorded on chloroform and polymer matrix on a Horiba Jobin-Yvon Fluoromax 4P spectrofluorometer. All scintillators were compared with approximately the same morphology (diameter, thickness).

UV-visible spectra were measured at room temperature in chloroform on a Jenway 6715 UV/Vis spectrometer.

InfraRed spectra were measured at room temperature using a smart orbit diamond ATR attachment on a THERMO electron© FTIR apparatus

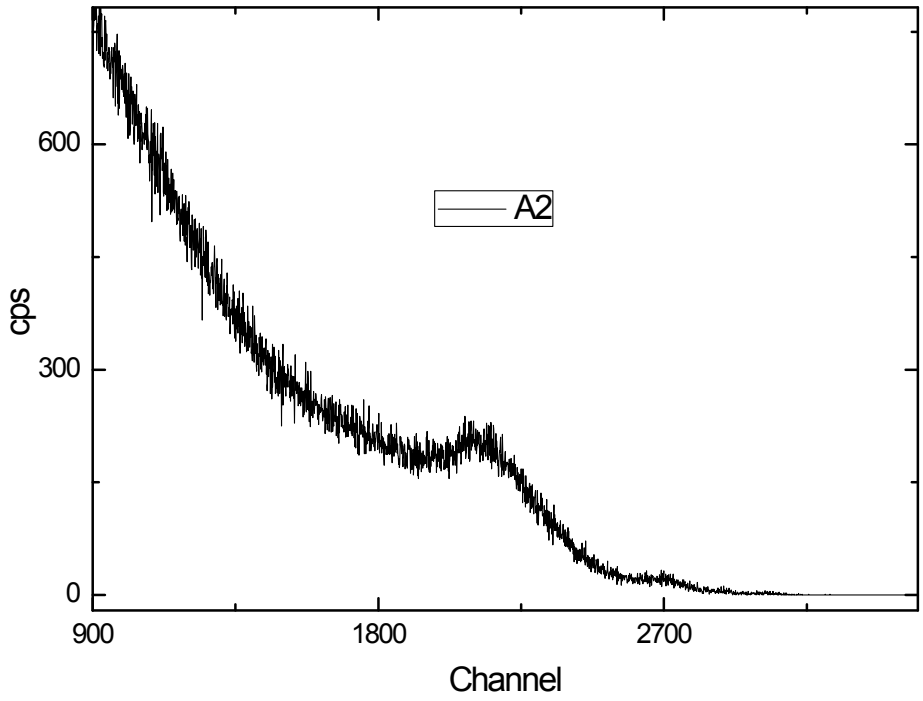

Figure S-1: ^{137}Cs pulse height spectrum of Scintillator A2 containing 3.9 wt% of Bi. The bump around channel 2700 was attributed to background radiation and not PE peaks

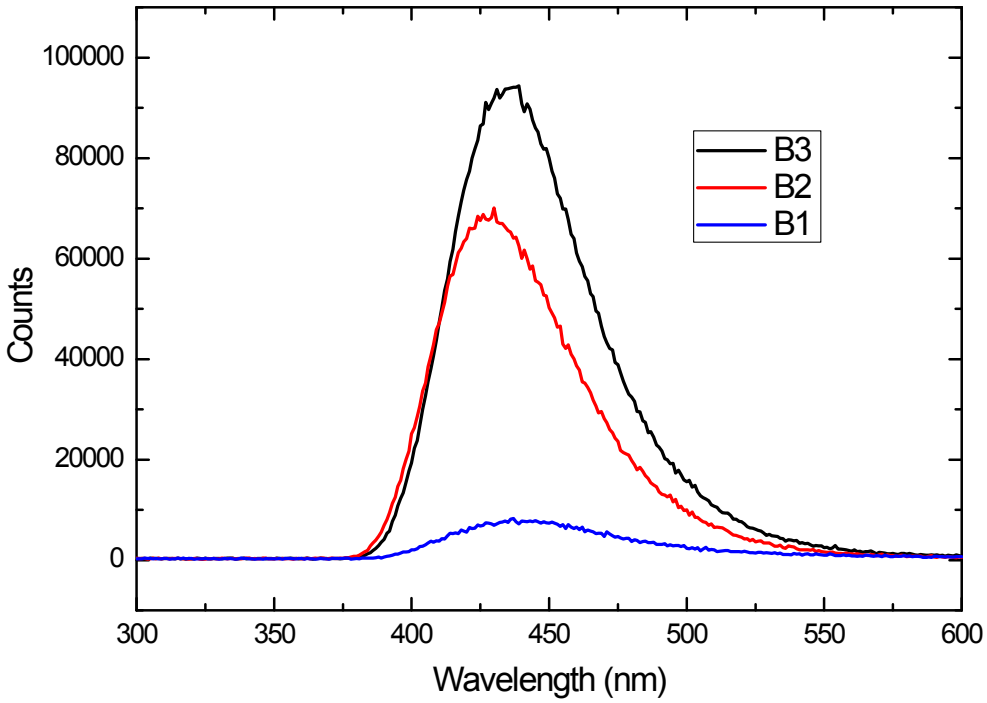

Figure S-2: Radioluminescence of scintillators B1 B2 and B3. B3 was set at 1,350 ph/MeV

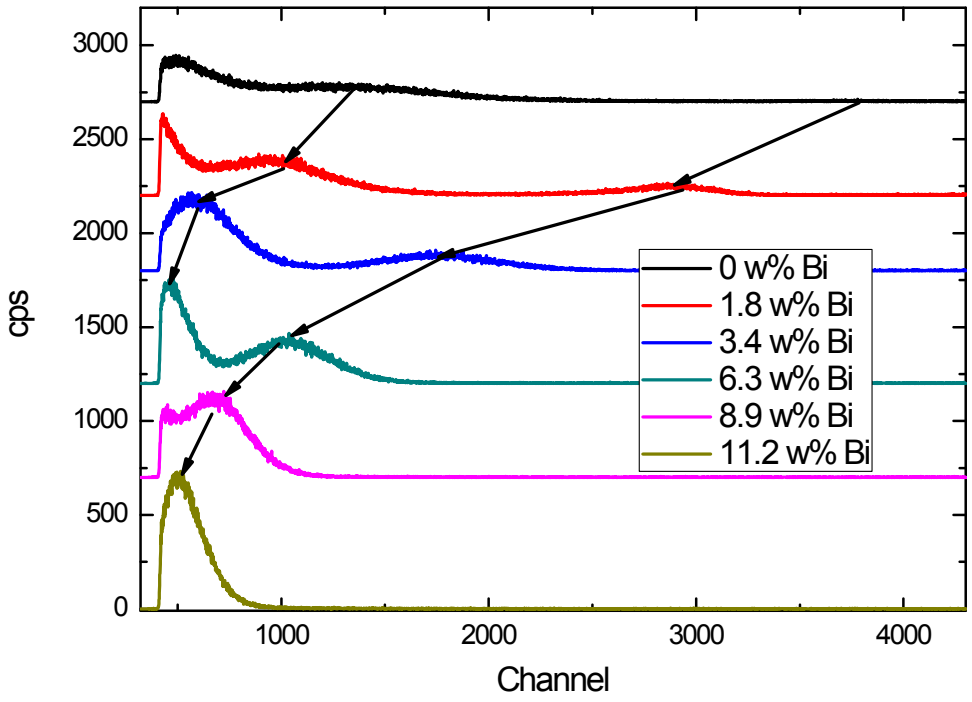

Figure S-3: ^{57}Co pulse height spectra with constant settings. C1 (top) to C6 (bottom)

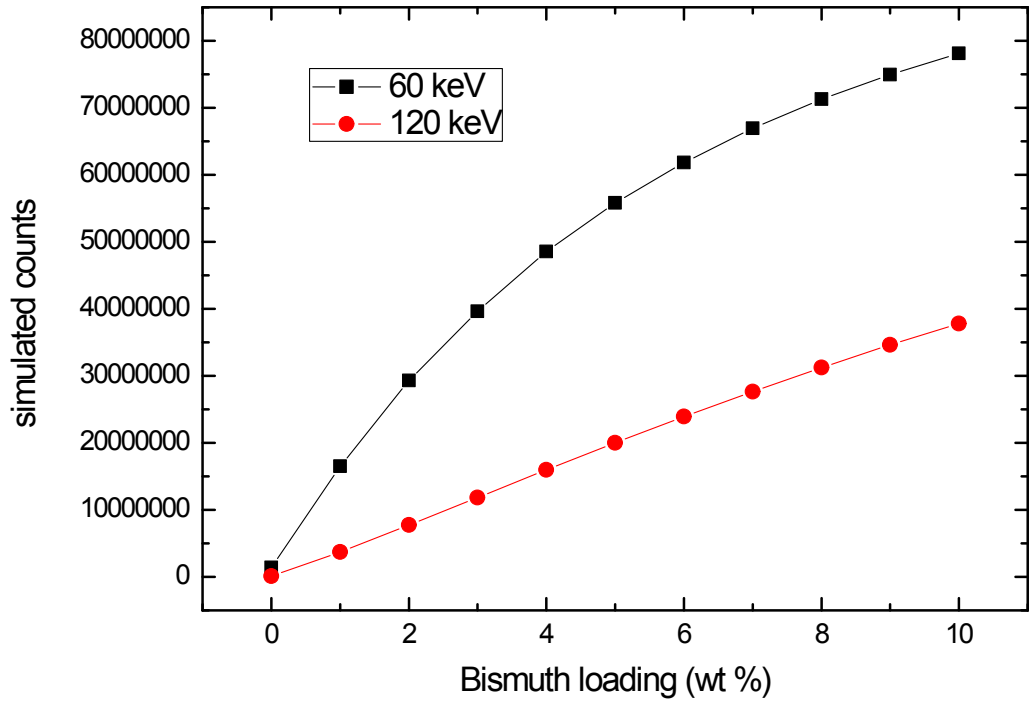

Figure S-4: Evolution of the count rate for a simulated cylindrical scintillator. (diam = 5 cm, h = 2.8 cm) loaded with bismuth under 60 keV and 120 keV gamma irradiation.

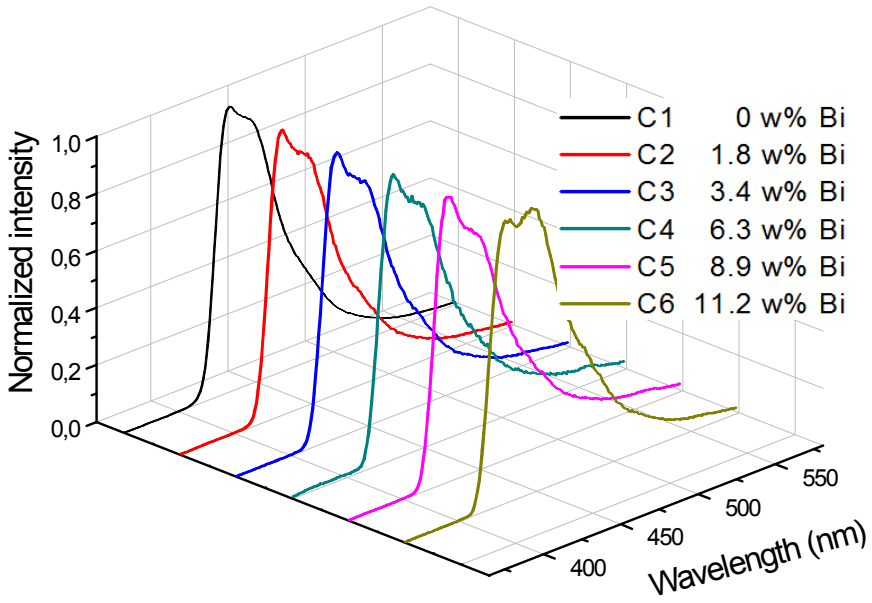

Figure S-5: Normalized emission spectra for scintillators C1 to C6.

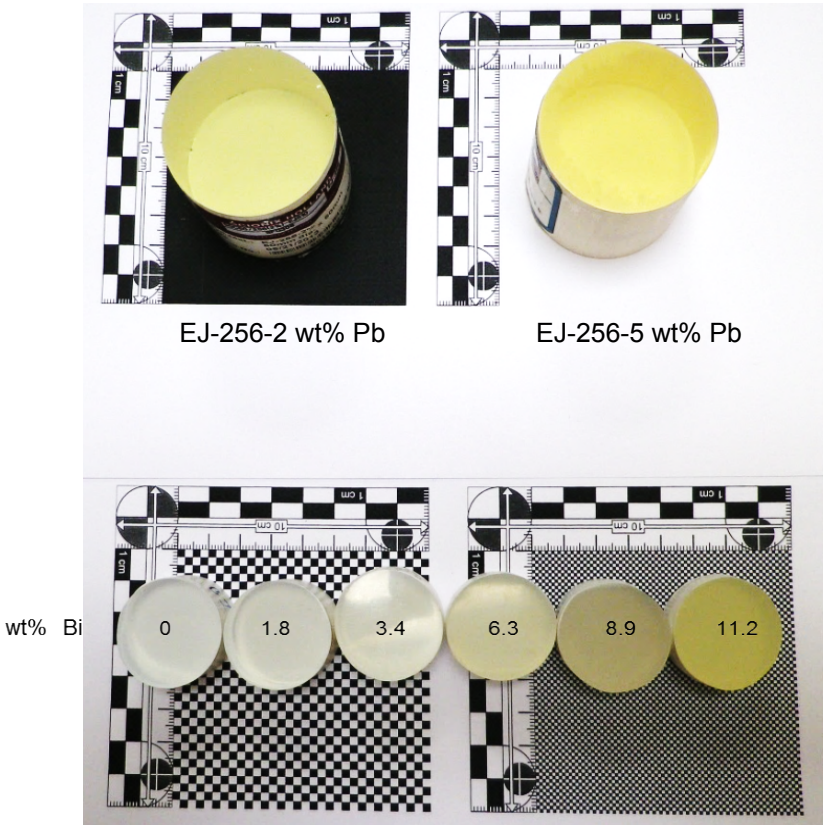

Figure S-6: Picture of commercial plastic scintillators EJ-256-2%, 5% and plastic scintillators C1 to C6, from left to right, with bismuth loading indicated.

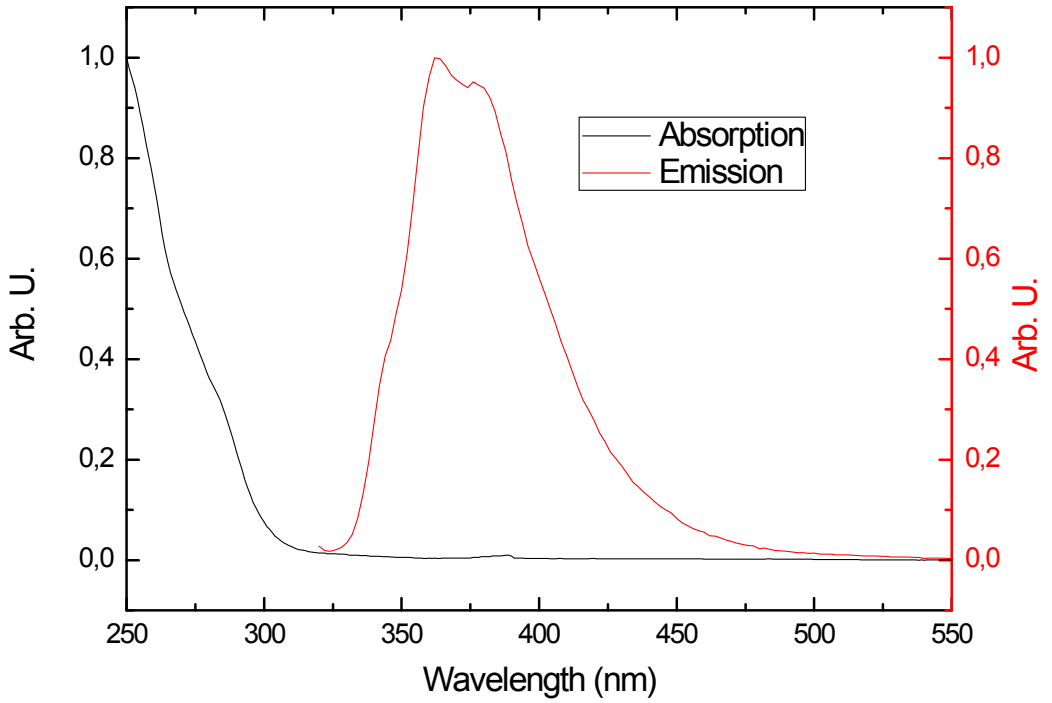

Figure S-7: Absorption and Emission spectra of [1]

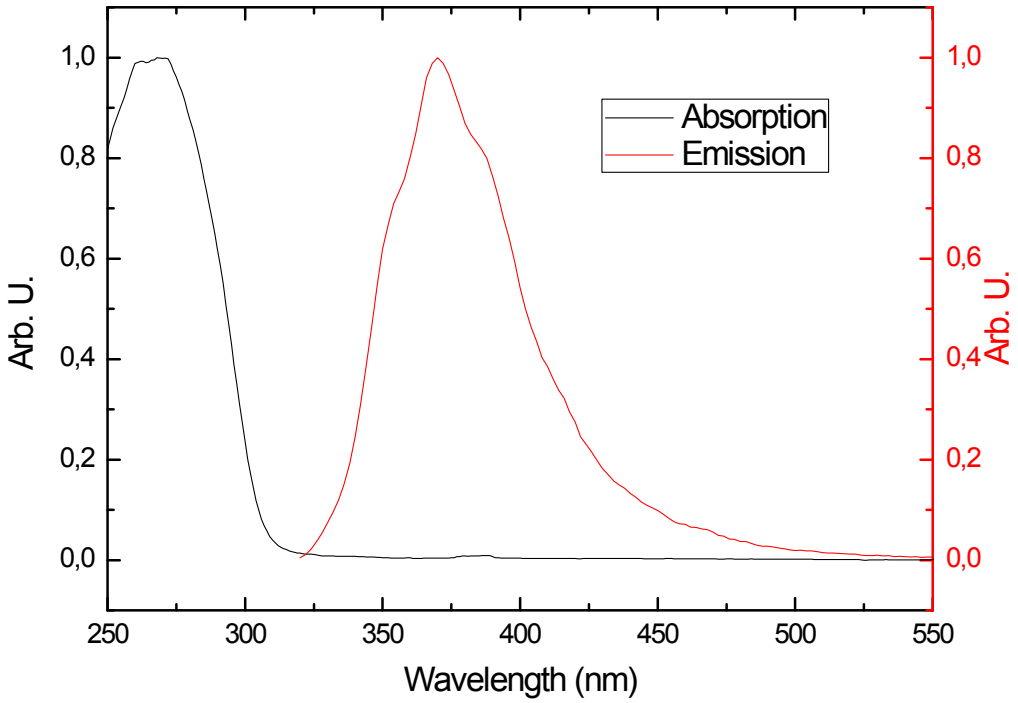

Figure S-8: Absorption and Emission spectra of [7].

Samples	Sources	Gamma ray (keV)	Resolution
C2	^{57}Co	122	27.5 %
EJ256 2%	^{57}Co	122	43.3 %
EJ256 5%	^{57}Co	122	71.5 %

Table S-1: PE Resolution calculated from Figure 8, for samples C2 and commercially available lead loaded materials with a ^{57}Co source.

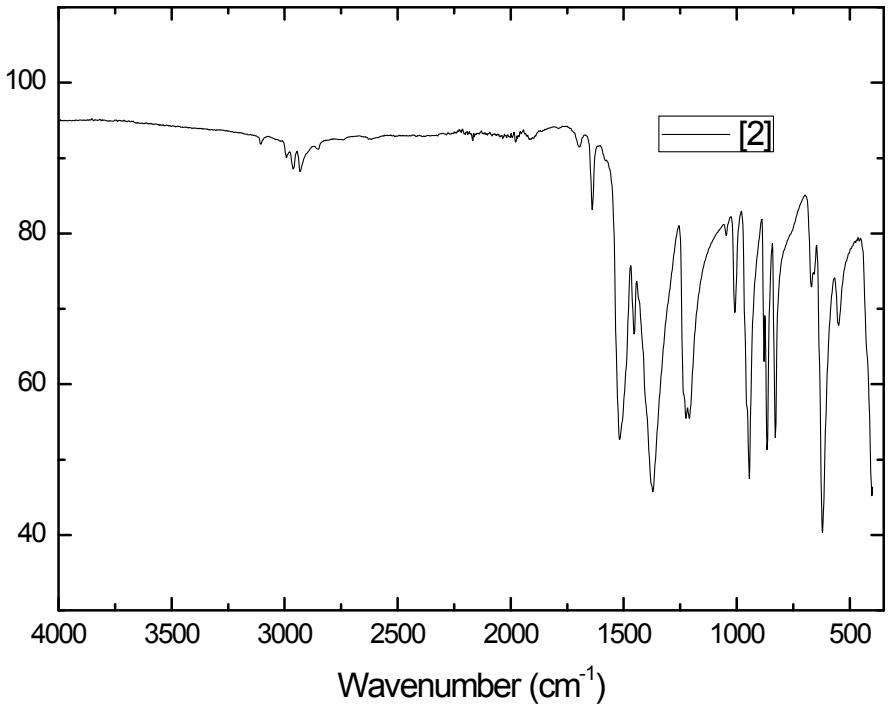

Figure S-9: IR spectra of [2].

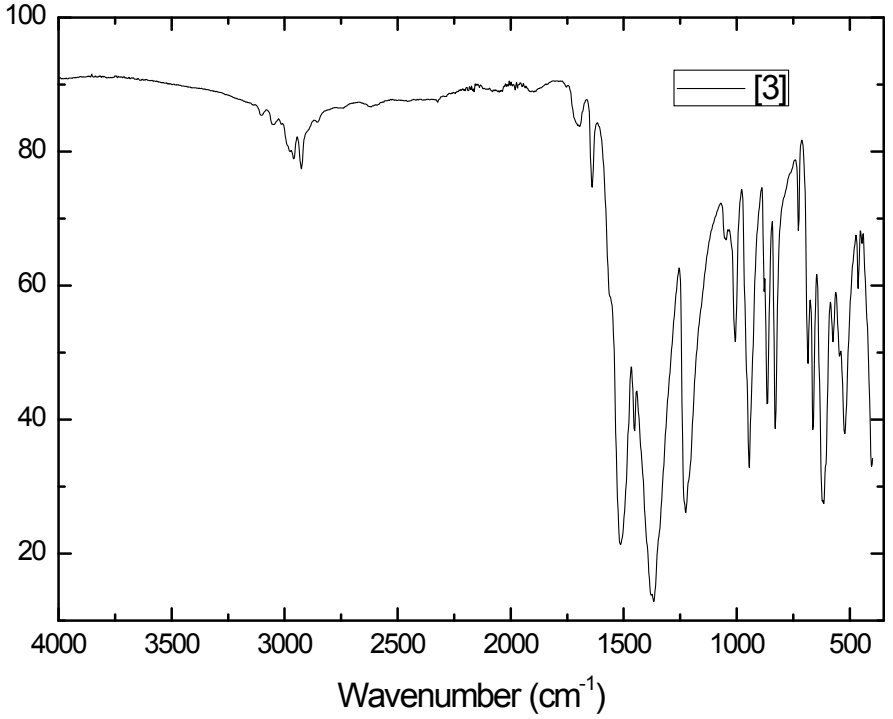

Figure S-10: IR spectra of [3].

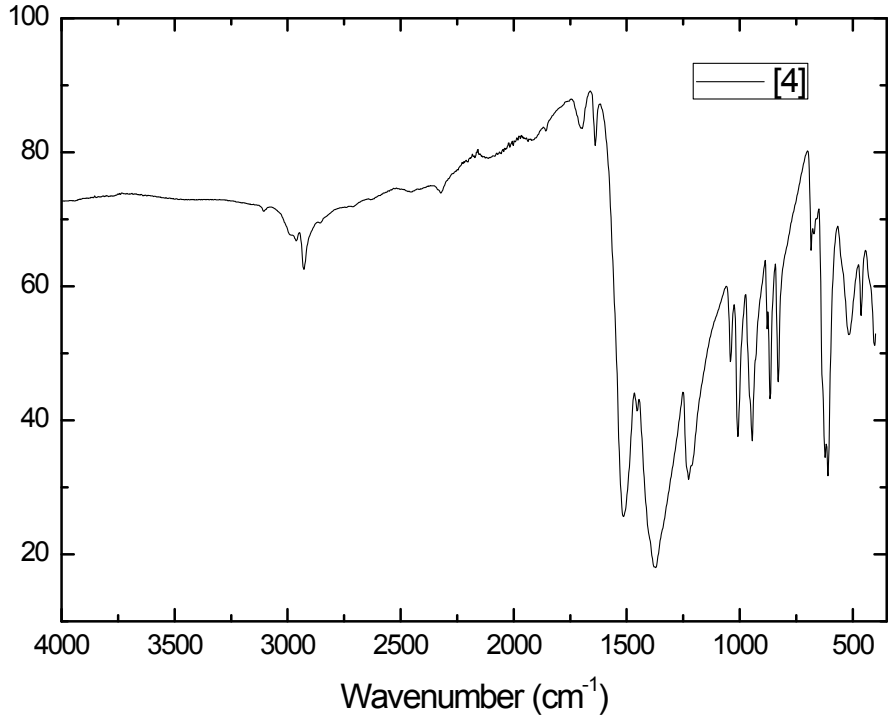

Figure S-11: IR spectra of [4].

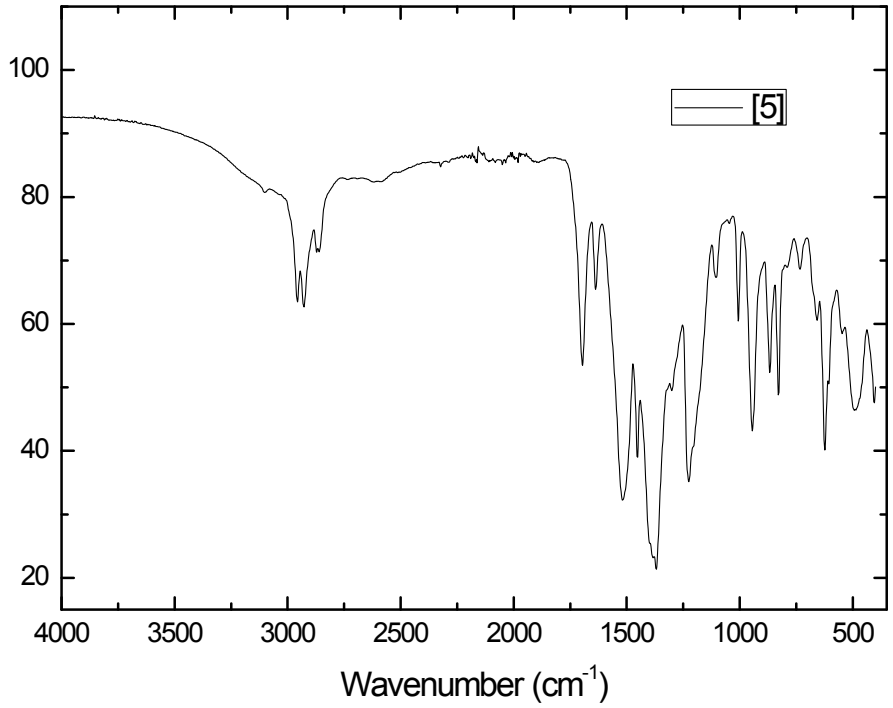

Figure S-12: IR spectra of [5].

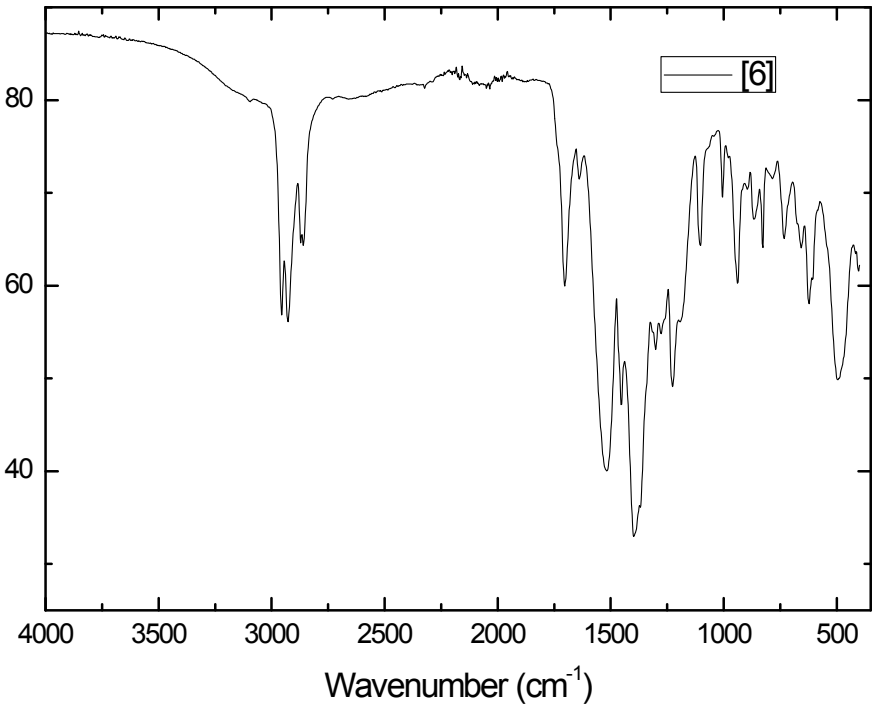

Figure S-13: IR spectra of [6].

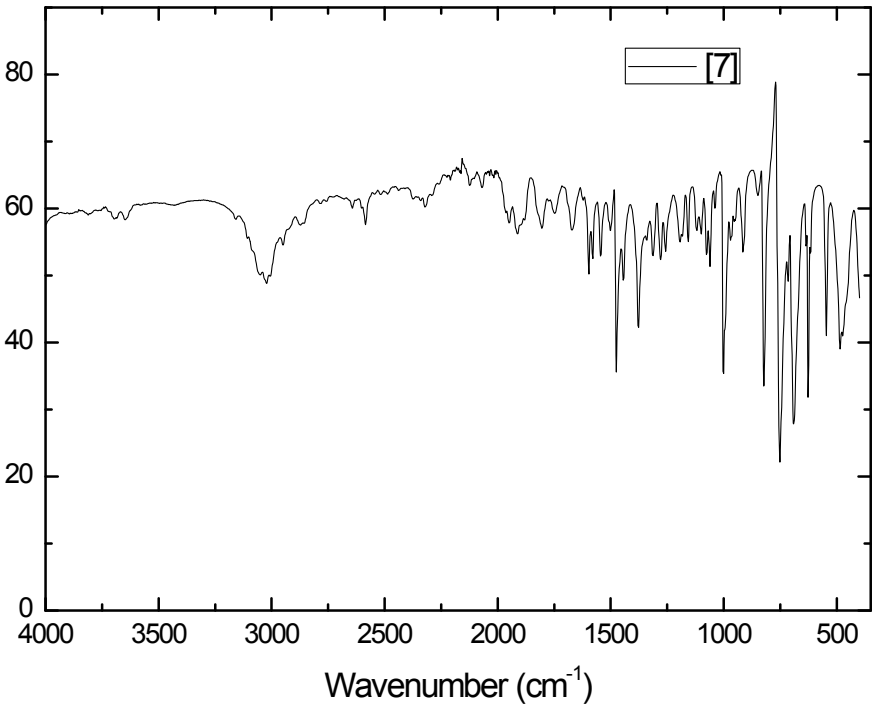

Figure S-14: IR spectra of [7].