Here in we report the syntheses of the thiol functionalised p-tert-butylicalix[4]arene from the reaction of p-tert-butylicalix[4] arene-dialkylbromide derivative with thiourea. The structure of the thiol functionalised p-tert-butylicalix[4]arene was determined by using 1 HNMR, 13CNMR and elemental analysis techniques. Furthermore, the thiol functionalised p-tert-butylicalix[4]arene, cellulose triacetate (CTA) and 2-nitrophenoxy octyl ether (oNPPE) in dichloromethane were used to make a new calixarene-embedded polymer inclusion membrane (But -C@PIM). The surface and structure morphology of But -C@PIM was detected using thermogravimetric analysis, elemental analysis techniques and scanning electron microscopy. The affinity (the percentage of metal ion transferred from the source solution) of a PIM towards a range of divalent cations was found to follow the order Pb2+ > Zn2+ > Ni2+ > Cu2+ > Cd2+ > Co2+. 