**ABSTRACT**

 In the present work, numerical simulation of a bi-cascaded surface plasmon resonance based fibre optic sensor using various noble metals has been carried out. The attenuated total internal reflection method along with Krestchmann configuration has been used to analyze the sensor. The thickness of the metal layer, its dielectric constants and the thickness, length and refractive index of the sensing layer is properly chosen and the sensitivity evaluation is done and the various sensor parameters have been optimized. The proposed sensor is bi-cascaded ie., it can simultaneously detect two kinds of substances. It provides reasonable values of performance parameters and hence finds application as a good chemical/gas/biosensor.