DEVELOPMENT OF AN OPTO – CHEMICAL SENSOR FOR THE INVESTIGATION OF METAL CATIONS

A PROJECT REPORT PRESENTED BY

THEVAKY MARKANDU

To the Board of Study in Chemical Sciences of the

POSTGRADUATE INSTITUTE OF SCIENCE

in partial fulfillment of the requirement

for the award of the degree of

MASTER OF SCIENCE IN ANALYTICAL CHEMISTRY

of the

UNIVERSITY OF PERADENIYA

SRI LANKA

2005

DEVELOPMENT OF AN OPTO – CHEMICAL SENSOR FOR THE INVESTIGATION OF METAL CATIONS

THEVAKY MARKANDU

The development of an opto-chemical sensor based on fibre optics for the investigation of the metal cations in solution is carried out, by the complexing agent amino derivative of 8-hydroxy quinoline immobilized on surface modified silica gel/sintered glass. The metal cations like Cu(II), Ni(II), Zn(II), Al(III), Co(II), and Fe(III) have been detected, by this means, at the concentration range from 5 ppm to 1000 ppm level.

Amino derivative of 8-hydroxy quinoline was synthesized from 8-hydroxy quinoline. Nitration of 8-hydroxy quinoline was followed by the reduction of the NO_2 group. Next the amino derivative of 8-hydroxy quinoline was attached with surface modified silica gel/sintered glass.

The brown coloured nitro derivative of 8-hydroxy quinoline was obtained, by the action of dilute nitric acid on 8-hydroxy quinoline, at room temperature. Then the nitro derivative was reduced, using mossy Sn/2M HCl, giving a coffee brown coloured amino derivative of 8-hydroxy quinoline. Thionyl chloride was used to modify silica gel/sintered glass, by converting the surface-OH group into surface-Cl group. Then the surface modified silica gel/sintered glass was treated with amino derivative of 8-hydroxy quinoline/pure chloroform in dry ether medium.

TLC, UV-visible spectroscopy, FT - IR spectroscopy, GC - MS, and optical fibre based scanning visible spectroscopy techniques were carried out during the construction of the opto-chemical probe. The sensor material, which produced visible colour changes with different metal cations in solution in the ppm range, was used for the development of an opto chemical sensor.

The reflectance based optical sensor for the investigation of metal cations has been constructed, based on the use of immobilized amino derivative of 8-hydroxy quinoline.

The reagent was immobilized, by adsorption on surface modified chromatographic grade silica gel/sintered glass, and the reflectance response calibration curves for the di or tri valent metal ions [Cu (II), Ni (II), Zn (II), Al (III), Co (II), and Fe (III)] measured. The respective λ max for each metal cation was calculated, and Cu (II) series/sintered glass λ max were calculated, by curve resolution.