DEVELOPMENT OF A VISUAL TEST FOR COPPER DETERMINATION IN SERUM OF HEMODIALYSIS PATIENTS

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INTRODUCTION AND AIMS:

Despite advances in the renal replacement therapy, particularly hemodialysis, a significant incidence of complications is an actual problem of modern clinical nephrology. A large number of studies suggest that inflammation and oxidative stress are associated with the adverse course of disease. The role of essential trace elements, particularly copper, in modulation of the intensity of oxidative stress and immune processes in hemodialysis patients is being studied.

Considerable progress has recently been made in developing multi-ion sensitive techniques which utilize analytical reagents immobilized on silica surface. This methodology is simple and inexpensive yet sensitive and informative. It requires small sample amounts and can be applied for express screening of biological fluids, particularly serum.

The aim of this work was to develop a new visual test technique for the direct copper determination in serum and application of such laboratory technique for determination of copper in serum of hemodialysis patients.

METHODS:

1-(4-Adamantyl-2-thiasolylazo)-2-naphthol immobilized onto silica surface has been proposed as effective solid-phase reagent for the adsorptional extraction of copper for the successive determination in the solid phase by using visual test technique. The interface interaction has been investigated. The modified silica demonstrates significant color change from bright orange to dark purple due to interaction with Cu(II) ions. The standard color scale range is 0.50-7.50 µg/per sample Cu(II), sample volume - 4.0 mL, time of analysis is 5 min.

Blood collection from 39 patients with end stage renal failure was carried out before the first HD session of the week.

RESULTS:

The data was compared to the results obtained using standard atomic-absorption spectroscopy technique (AAS). The data obtained are listed in Table.

Average concentration of Cu(II) in serum of HD patients (n=39, P=0.95)

Ion	VT technique		AAS	
	$x\pm\Delta x$, ppm	SD	$x\pm\Delta x$, ppm	SD
Cu(II)	0,782±0,068	0,21	0,797±0,067	0,21

Data obtained follows normal distribution. Paired t-test showed no significant (α=0.05) difference between results obtained by two methods (t_{exp}=1.476, $t_{crit}(\alpha/2$=0.025, f=37)=2.026. Accuracy and precision of the results are satisfactory.

CONCLUSIONS:

Due to it simplicity and reliability the visual test technique on the base of modified silica can be used for the analysis of multiple biological samples providing valuable analytical information. The developed visual test technique can be recommended for the rapid Cu(II) determination in serum in the clinic laboratories.