

THE PRODUCTION OF S-PHENYLMERCAPTURIC ACID (PMA) ANTISERA AND THE DEVELOPMENT OF BENZENE BIOMONITORING IMMUNOASSAYS FOR LABORATORY AND POINT OF USE TESTING.

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Objectives

Benzene is an important industrial chemical, a ubiquitous pollutant and known carcinogen. PMA is a specific urinary metabolite of benzene and its measurement has facilitated benzene biomonitoring. However, current methods of analysis are laboratory based, laborious and provide slow sample turnaround. Immunoassays overcome these limitations and enable the development of point of use tests.

Methods

Using PMA-protein conjugates biomarker specific antisera were induced in sheep. A urinary ELISA was developed, validated and used to detect PMA in workers exposed to benzene. A lateral flow test, which will allow "in the field screening," is being considered.

Results

Test kits have been used to detect elevated levels of PMA in the urine of workers exposed to benzene. Occupational samples (n=39) determined by ELISA and GC-MS (range 0-1130µg/l) were in good agreement (Corr. Coeff. = 0.9). Optimisation of a lateral flow test is underway.

For point of use testing careful consideration was given to urine hydration. The target is for a test cut-off which will distinguish between concentrated urines containing background levels and dilute urines containing elevated levels of PMA. Analysis of a UK database of occupational samples (n=2000) shows that a target cut-off of 7.5µg/l would result in 12% of samples screening positive. 7.5µg/l is roughly a third of the current US (ACGIH) guidance value and seems a reasonable level for requiring laboratory confirmation and possible workplace intervention.

Conclusion

Immunoassays enable the production of cost-effective benzene biomonitoring tests. An ELISA kit has been produced which will allow laboratories to provide a routine test service. A point of use test is being optimised. This will enable on-site testing and provide immediate confirmation of good working practice. These developments will increase the utility of benzene biomonitoring and improve the protection of workers health.