Atmospheric Environment Pergamon Press 1970. Vol. 4, pp. 667–670. Printed in Great Britain.

DETERMINATION OF CHRYSOTILE IN AIRBORNE ASBESTOS BY AN INFRA-RED SPECTROMETRIC TECHNIQUE

J. A. GADSDEN, J. PARKER and W. L. SMITH

Warren Spring Laboratory, Ministry of Technology, Stevenage, Herts., U.K.

(*First received* 1 *June* 1970 *and in final form* 10 *August* 1970)

Abstract—A new method of determining chrysotile in airborne asbestos using infra red absorption at 2·72 μm is described. The technique is rapid, simple and allows detection of chrysotile down to about 20 μg in the sample, provided that the serpentine minerals of related structure (e.g. Kaolinite) are absent.

INTRODUCTION

INCREASING attention is now being paid to the health hazards arising from the inhalation of airborne asbestos (H.M. FACTORY INSPECTORATE, 1968), and in consequence of this, improved methods for the determination of chrysotile and other asbestos minerals in airborne dusts are of wide interest. Recently GOODHEAD and MARTINDALE (1968) have reported an X-ray diffraction technique which possesses a number of advantages, but which needs about 30 mg of sample. In this note we describe an i.r. spectrometric method used in this Laboratory for the determination of chrysotile. The technique is rapid, simple and allows detection of chrysotile down to about 20 μg in the sample. The method suffers from the disadvantage of being non-specific within the serpentine class of minerals. In the absence of other serpentine minerals e.g. kaolinite, as was usually the case, the method is specific for chrysotile asbestos, the form of asbestos most used commercially.

EXPERIMENTAL TECHNIQUE

Chrysotile in common with other serpentine minerals possesses a sharp i.r. absorption band at 2·72 μm which is associated with the stretching vibration of the lattice hydroxyl groups present in the layer silicate structure. The band is fairly well separated from the broad absorption arising from the free or weakly adsorbed water molecules present in most solid samples (see FIG. 1). The analogous bands in the amphibole asbestos minerals (amosite, crocidolite, etc.) are considerably weaker and are not suitable as the basis for an analytical technique.

In this work potassium bromide discs containing known amounts of chrysotile in the range 0·04–0·65 mg were prepared by the standard procedure (see, for example, MARTIN, 1966). Values of extinction $\log_{10} I_0/I$, where I_0 and I are the incident and emergent intensities of radiation respectively, measured at the peak of the 2·72 μm band, were determined from spectra recorded on a Grubb–Parsons "Spectromaster" i.r. spectrometer, and were found to be proportional to the mass of chrysotile present in the disc (FIG. 2). The sensitivity of the method is such that at the lowest levels of chrysotile content (< 100 μg) difficulties arose in preparing standard discs containing such small amounts of material; however, the calibration graph is sufficiently linear to allow a reasonable extrapolation, and indicates a lower limit of detection of ~20μg.