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ScienceDirect
Environmental Pollution 148 (2007) 627–633
ENVIRONMENTAL POLLUTION
www.elsevier.com/locate/envpol

Use of handheld X-ray fluorescence spectrometry units for identification of arsenic in treated wood

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Received 13 May 2006; received in revised form 17 November 2006; accepted 19 November 2006

Handheld XRF analyzers provided quantitative results for the amount of arsenic within preservative-treated wood.

Abstract

The objective of this study was to evaluate the performance of handheld XRF analyzers on wood that has been treated with a preservative containing arsenic. Experiments were designed to evaluate precision, detection limit, effective depth of analysis, and accuracy of the XRF arsenic readings. Results showed that the precision of the XRF improved with increased sample concentration and longer analysis times. Reported detection limits decreased with longer analysis times to values of less than 1 mg/kg or 18 mg/kg, depending on the model used. The effective depth of analysis was within the top 1.2 cm and 2.0 cm of sample for wood containing natural gradients of chemical preservative and concentration extremes, respectively. XRF results were found to be 1.5–2.3 times higher than measurements from traditional laboratory analysis. Equations can be developed to convert XRF values to results which are consistent with traditional laboratory testing.

Keywords: XRF; Treated wood; Arsenic; Handheld

1. Introduction

The recent development of a handheld unit that employs XRF (X-ray fluorescence) technology to rapidly identify elements has allowed for multiple field applications. These applications include the analysis of metals in soil (Vanhoof et al., 2004) and sediment (Hou et al., 2004; Stallard et al., 1995), the analysis of metals in aerosols collected on a filter (Kuznetsova et al., 2004), lead dust wipe analysis (Sterling et al., 2000), analysis of artifacts and art (Hou et al., 2004; Szökefalvi-Nagy et al., 2004) and the classification of hazardous wastes (Kalnicky and Singhvi, 2001; Rossini and Bernardes, 2005; Wolksa, 2005). XRF has also been used traditionally for the analysis of preservatives within pressure-treated wood (AWPA, 2005, Method A9-01). These traditional analyses require the use of large non-portable desktop systems and a considerable amount of sample pre-processing including grinding and compaction of wood samples. The advent of handheld XRF units has increased their portability and has decreased the need for pre-processing making the units ideal for analysis of wood in the field.

Wood may be pressure-treated with a variety of chemicals to protect it from rotting. One of the most popular wood preservatives has been CCA (chromated copper arsenate), which contains high levels of arsenic (2000–20 000 mg/kg). Although this preservative was phased out effective December 31, 2003 for most residential and consumer uses (US EPA, 2002), an abundance of treated wood containing arsenic can

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doi:10.1016/j.envpol.2006.11.013