J Forensic Sci, Oct. 1982, Vol. 27, No. 4

BOOK REVIEW

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A Review of *The Analysis of Explosives*

REFERENCE: Yinon, J. and Zitrin, S., *The Analysis of Explosives,* Volume 3 in the Pergamon Series in Analytical Chemistry, Pergamon Press, Elinsford, NY, 1981, 310 pages, $60.00 hardcover, $22.50 softcover.

The authors present a monograph to serve as a reference book for chemists in analytical and forensic science laboratories and as a textbook for graduate students studying analytical chemistry and the forensic sciences. This text is truly needed and welcomed by explosives chemists, especially those who work in the forensic sciences. While the book is partially intended as a text for graduate students, the reviewers believe that junior and senior level undergraduate students could also benefit significantly from the subject material. Overall, the theory, subject matter, references, and discussion of methods and instrumental techniques are comprehensive and well presented and should be easily understood by advanced forensic and graduate chemistry students.

Chapter 1 on the Classification of Explosives discusses explosives and related compounds in two main categories, and only the outstanding treatise by Urbansky is referenced. From the scope of this book, there should have been more detailed information presented on the classification of explosives, because most texts on this subject refer to three or more categories of explosives. The material found in the *Encyclopedia of Explosives and Related Items,* Volume 6, PATR 2000, Picatinny Arsenal, Dover, NJ, and Johansson and Peterson, *Detonics of High Explosives,* Academic Press, New York (1970) with references, in addition to Urbansky's material, would have provided a more thorough and fundamental understanding of explosives, their uses, and classifications.

Several of the more common explosive mixtures encountered in the United States are not mentioned by the authors, such as commercial mixtures of binary explosives (Kinepak®, Kinestik™, Kinepouch™, Atlas Powder Co., Dallas, TX; Marine Pac, XPLO Corp., Gretna, LA; Astropak, developed by Explosives Corp. of America and marketed by Hercules Inc., Wilmington, DE; Triex-L; and others). Although these mixtures are not explosive until mixed, they are very effective explosives frequently found in bomb debris and used in explosive devices in the United States. In addition, the formulations of the water gel type explosives, which are replacing dynamite in the United States, were not discussed. Large quantities of gels are used in the United States and the problems these gels and the binary mixtures present to the forensic chemist are, to say the least, a challenge. Their residues in bomb debris are difficult to find or verify.

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The discussion of Chemical Methods in Chapter 2 is comprehensive and well organized. The compilation of proposed structures for the various reactions will be helpful to both the student and the forensic chemist. The authors list several publications concerning spot tests; however, they should have noted the color reaction charts in the *Encyclopedia of Explosives and Related Items,* Volume 3, to provide a more complete compilation of reference material on this subject.

The comments in Chapter 6 on the work by Basch and Kravs on the characterization of the manufacturing sources of TNT can be misleading. The reader should be aware that research using a wide variety of techniques has been conducted by several countries in an attempt to identify the manufacturing source of TNT and, to date, no definitive conclusions can be made concerning the origin of TNT.

Chapter 14, Detection and Identification of Residues, provides adequate guidance for the forensic chemist called upon to examine blast debris and residues of explosives. The analysis scheme of Beveridge et al is most useful except when water gels are encountered. Currently, methanol is the solvent of choice for the extraction of gels because of the decomposition of gels in acetone.

The subsection on vapor analysis of explosives should have mentioned the work of other investigators such as Yander and Hanley, "Post Explosion Detection of Nitrate Esters," and Jarke et al, "Explosive Vapor Characterization." (See *Proceedings: New Concepts Symposium and Workshop on Detection and Identification of Explosives,* U.S. Departments of Treasury, Energy, Justice, and Transportation, Reston, VA, 1978.) Jarke et al have done extensive research on the detection of explosive vapors.

The section that discusses explosive tagging for identification in this chapter is incomplete and does not provide direct reference to any scheme of analysis for the recovery of "taggants" from blast debris. The United States piloted an explosives tagging program on commercial dynamite; however, the addition of taggants to explosives by United States manufacturers was discontinued in 1979. While some European countries are considering the adoption of explosives tagging programs, it is doubtful that taggants will be found in any significant number of bombing incidents in the foreseeable future.

Experience has shown that the recovery of explosives taggants from bomb debris is not a simple task and not as straightforward as the authors or references depict. The Bureau of Alcohol, Tobacco and Firearms has recovered taggants from bomb debris and has successfully used these procedures in actual criminal cases in which convictions were obtained. However, the discontinuation of the explosives tagging program in the United States has eliminated the need for laboratories in this country to include the recovery of explosives taggants in their general scheme for the examination of explosives debris.

In their discussion of techniques for the identification of explosives, the authors should have made reference to the applications of the polarizing microscope for this purpose. McCrone et al, of McCrone Research Institute, Inc., Chicago, have described excellent analysis schemes in which both macro and trace amounts of explosives can be identified with the polarizing microscope.

Chapter 15, "Detection of Hidden Explosives," surveys its subject as thoroughly as possible considering the proprietary nature of this information. The reviewers feel the remaining chapters are complete, well presented, and informative.

In summary, despite some omissions, the reviewers think *The Analysis of Explosives* is an excellent contribution to the field. It will direct the investigator to sources of information about explosives that were previously unavailable in a single text. Because the text has some of the qualities of a manual and is an excellent reference source book of current literature, all forensic chemists involved in trace explosives analysis should have ready access to this work.