CYCLIC VOLTAMMETRIC DETERMINATION OF NITRAMINE-TYPE ENERGETIC MATERIALS

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Gas chromatography (GC), high performance liquid chromatography (HPLC), and ion mobility spectrometry (IMS) are among the most widely used instrumental methods for determining nitramine-type explosives. However, electroanalytical methods (such as voltammetry) are much less expensive and laborious with more readily portable instrumentation [1]. In this study, an electrochemical determination method has been developed for RDX (1,3,5-trinitroperhydro-1,3,5-triazine or 1,3,5-trinitro-1,3,5-triazacyclohexane), the most widely used nitramine-type polynitro explosive. RDX is a fundamental component of various commonly used military explosives. A relatively high negative potential is necessary for reduction of nitramines and nitrates in voltammetric determination [2].

The performance of the voltammetric method is dependent on the electrode used, and requires that all water and oxygen be removed from sample solution. Because of this requirement, the support electrolyte tetrabutylammonium bromide (TBAB) salt was dried at 50 °C temperature and 90 kPa pressure, and anhydrous acetonitrile (purified from moisture with molecular sieves) was used to prepare RDX solution. The calibration line of dried RDX was constructed within 30-120 mg/L range. The characteristic peak of RDX was found at -0.78 V potential. The linear calibration equation for RDX was found as: Current intensity: I (µA) = 0.18 c(mg/L)+5.78 (r=0.9975). The developed method was successfully applied to the determination of RDX and TNT in various military purpose explosives: Comp B (containing 60 % RDX, 39 % TNT, and 1 % paraffin wax), Comp C4 (containing 91 % RDX, 2 % polyisobutylene, 5.3 % dioctyl sebacate, and 1.6 % oil), and Comp A5 (99 % RDX and 1 % filler material).

References