Aims and Objectives

Chapter 3
AIMS AND OBJECTIVES

a) The objective of these investigations is on the disposal of larger amounts of solid HE (Spontarelli et al., 1994) The solubility of HMX in water is low (5 ppm, Rosenblatt et al., 1991). The present studies will investigate possible ways of treatment using combined technique of chemical and biological means.

b) In order to get basic data for the design of a novel treatment scheme for HE we investigated the kinetics for the aqueous alkaline hydrolysis of HMX and the temperature dependence of the rate constants. High Performance Liquid Chromatography (HPLC) will be used for the analysis of HMX/RDX. All experimental data will be analyzed to get reaction rate constants. Temperature dependence will be modeled with the Arrhenius equation.

c) Destruction of waste explosives by ‘Hydrogenolysis’ will also be studied, using Nickel and hydrogen. Heterogeneous and homogeneous catalysis will be studied. Effect of dilute ammonia and hydroxide salt solution in presence of metal powder at moderate temperature will also be studied.

d) The products obtained from hydrolysis of PBX 9404 have not yet been fully characterized. If it is determined that base hydrolysis produces a hazardous waste, a secondary treatment method will be needed. We are investigating two methods of treating the hydrolysis product solution: biotreatment and supercritical water oxidation (SCWO).

e) The studies can be carried out for the time required for complete destruction of the HEs, dependence on temperature, stirring efficiency, particle size of the material, and concentration of sodium hydroxide. Particle size and stirring dependence indicate the reaction is mass transfer limited. A sodium hydroxide concentration study will be performed using concentrations in the range of 0.5 to 5.0 molar. The reaction mixtures will be heated to 85°C and held at that temperature for 1 h. They will than be cooled in ice, filtered, and the solid residue (HMX) will be dried and weighed to calculate the
Aims and Objectives

percentage of PBX 9404 reacted. The reactions were performed with 10ml and 30ml of hydrolyzing solution per gram of PBX 9404.

If a secondary treatment is necessary, coupling of base hydrolysis to bio-treatment or SCWO may result in a non hazardous waste stream that could be discharged directly. Preliminary results from both of these processes are promising.

f) The thermolysis of HMX/RDX/TNT will be investigated using non-isothermal TG-DTG and DSC under an inert gas and atmosphere gas conditions, to find out decomposition temperature and energetics.

g) Though chemical processes are available to absorb/inactivate explosive compounds but all of them are uneconomical and environment unfriendly. Biological methods of treatment are economical and eco-friendly. The objective of the biological degradation studies is to find biological means, which can degrade the explosive compounds and chemically degraded explosive compounds to environment friendly products.