

Adsorption of Munitions Constituents via Cellulose, Cellulose Triacetate, Chitin, and Chitosan

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Background/Objectives. Current treatment technologies for waters contaminated with insensitive munition compounds are inefficient or unsustainable. Additionally, the current state of the science regarding treatment technologies for these waters is limited. Thus, evaluations were conducted such that insensitive and traditional munitions constituents within solution were analyzed for adsorption onto the surface of the following biopolymers: cellulose, cellulose triacetate, chitin, and chitosan.

Approach/Activities. Specifically, the following adsorbates were evaluated: 2,4-dinitroanisole (DNAN), nitroguanidine (NQ), 2,4,6-trinitrotoluene (TNT), and 1,1-diamino-2,2-dinitroethene (FOX-7). These evaluations were performed at the laboratory scale via 24-hr batch adsorption tests at two different adsorbate concentrations.

Results/Lessons Learned. These evaluations showed significant adsorption of DNAN and TNT via cellulose triacetate; over 90% of these munition compounds were removed from solution. However, moderate or minimal adsorption of the other munition constituents by the biopolymers evaluated was observed. Thus, distribution coefficients (K_d) were evaluated for DNAN and TNT after 24-hr exposure to cellulose triacetate. Isotherms displaying the adsorption trends between these munition compounds and cellulose triacetate were prepared; a linear isothermal model proved to be accurate for this analysis. This research suggests the use of cellulose triacetate as a renewable material for treatment of DNAN and TNT in solution. Therefore, the sustainability of the water treatment regarding munitions constituents is further advanced.