Detection and Characterization of Sugar in Homemade Explosives (HMEs) by Liquid Chromatography–Tandem Mass Spectrometry (LC-MS/MS) and Nuclear Magnetic Resonance (NMR)

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Homemade explosives (HMEs) are commonly utilized in terrorist attacks throughout the world. Identification and subsequent characterization of the chemical constituents of these explosive devices are a main priority to anti-terrorism branches of the U.S. Army and other government authorities. HME devices are conventionally composed of materials that are facilely attainable and low in cost. Typically, an explosive device is composed of a fuel and an oxidizer, along with other components that ameliorate handling properties and/or increase the heat of combustion. One of the most easily obtained fuels for these devices is simple sugars. Simple sugars are typical monosaccharides or disaccharides, such as ribose (health supplement), fructose (fruits and honey), and sucrose (table sugar). This study focuses on the identification of sugar HMEs with LC-MSMS and NMR.

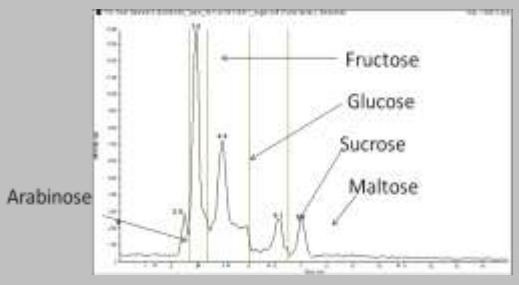

Figure 1. Chromatogram of 5 sugar standard mixture using scheduled SRM transitions.

A five (5) sugar mixture consisting of the one pentose (Arabinose), aldohexose (Glucose), ketohexose (Fructose) and two disaccharides (Sucrose and Maltose) were analyzed by LC-MS/MS. Two solutions of ~1 mg/mL Glucose and Galactose were compared using NMR. Studies were performed separating the 5 sugar mixture (Figure 1). Monosaccharides could be separated from disaccharides and within the monosaccharide class, pentoses could be separated from hexoses, and aldohexoses could be separated from ketohexoses. Problems arose when separating sugars from the same class, as they had very similar retention times and tandem mass spectra. NMR presented a solution to this problem by differentiating the two aldohexoses.

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