INTRODUCTION

Hydrotalcite is one of the few minerals with significant, permanent anion-exchange capacity, and stands in contrast to the more common clay minerals which have cation-exchange properties. Ideal hydrotalcite has a structural formula of Mg_6 Al_2 (OH)_{16} CO_3 ·4H_2 O (e.g., Reichle 1986) and consists of positively charged brucite-type octahedral sheets, alternating with interlayers containing carbonate anions and water molecules. The net positive charge on the octahedral sheets is due to the partial substitution of Al for Mg. Structure refinements yield Mg and Al disordered over the octahedral sites (Bellotto et al. 1996). The actual Al/(Mg + Al) ratio varies from 0.2 to 0.45 (e.g., Titulaer et al. 1996).

Hydrotalcite-like compounds (HTs, Carrado et al. 1988) are structurally similar to hydrotalcite, but contain a wide variety of interlayer anions and 1+, 2+, 3+, and 4+ cations on the octahedral sites (e.g., Drits et al. 1987; Ulibarri et al. 1987; Ookubo et al. 1994; Titulaer et al. 1996). HTs can be synthesized either by direct co-precipitation from aqueous solution (Miyata 1975; Miyata and Okada 1977) or by exchange of interlayer anions already present in host HTs (Hansen and Taylor 1991; Reichle 1986). Products obtained from either method can be hydrothermally recrystallized to increase particle size. Hydrotalcite-like compounds have aroused increasing interest because of their ability to exchange organic and inorganic anions, and thus their potential applications in the management of hazardous chemical and radioactive waste (Abdelouas et al. 1994; Wada and Masuda 1995; Ulibarri et al. 1995; Amin and Jayson 1996; Hermosin et al. 1996; Olguin et al. 1998). As for many silicate-based clay minerals, the structural environments and dynamical behavior of the interlayer and surface species in HTs, which are most crucial to such applications, are difficult to study and poorly understood. NMR spectroscopy is an effective technique in addressing these issues due to its unique ability to simultaneously probe element-specific local structure with high resolution and to investigate atomic and molecular motion in the relevant 10^2–10^6 Hz frequency range (Kim et al. 1996; Kirkpatrick et al. 1999, and references therein). For HTs, NMR has been previously used to study only _13 CO_2, _2 H_2 O, _35 Cl_, and octahedral _27 Al_ and _24 Mg_ (Marcelin et al. 1989; Dupuis et al. 1990; Mackenzie et al. 1993; van der Pol et al. 1994; Kirkpatrick et al. 1999). We present here the first _15 N NMR study of nitrate-containing HT with emphasis on the contrast-