Rotational spectra of NCS in the excited bending vibrational states have not been analyzed in detail, because of difficulty in analysis due to large Renner-Teller effect and anharmonic interactions. We have extended the observation of the pure rotational spectra of NCS in the $v_2 = 1$ as well as in the $X^2\Pi$ ground state up to $J = 53.5$ in the submillimeter wave region. For the ground state, the analysis was straightforward. The measured transition frequencies were fit to a standard effective Hamiltonian for $^2\Pi$ vibronic states, and the improved molecular constants including the higher order centrifugal distortion constants were obtained. The $v_2 = 1$ vibronic state splits into four vibronic sub-states, $^2\Delta_{5/2}, ^2\Delta_{3/2}, ^2\Sigma$ and $^2\Sigma$. As a first attempt, the $\Delta$ and $\Sigma$ states were fitted separately to effective Hamiltonians. The least square fittings converged by including various effective parameters concerned with the $P$-type doubling. However, the physical significance of these higher order parameters is not clear. It is found that the spin rotation coupling constant, $\gamma$, and the $\Lambda$-type doubling constants, $p$, $q$, are significantly different from those for the ground state. We have attempted to analyze the $\Delta$ and $\Sigma$ states simultaneously by taking into account the perturbations from higher vibrational states.

An isotopic species, NC$^{34}\text{S}$, in the $X^2\Pi_{3/2}$ state has also been measured and $r_0$ structure is derived to be $r_0(\text{NC}) = 1.1805(1)$ Å and $r_0(\text{CS}) = 1.63212(7)$ Å.