ORTHOTO-PARA ABUNDANCE RATIO OF CYCLIC-C$_3$H$_2$ IN DARK CLOUD CORES

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We have observed four emission lines of cyclic-C$_3$H$_2$ in the millimeter region with Nobeyama 45m radio telescope toward five cloud cores in TMC-1. From the observed intensities, the density of H$_2$ molecules and the fractional abundance of ortho(O) and para(P) of c-C$_3$H$_2$ were calculated using the LVG model. The O/P abundance ratio of c-C$_3$H$_2$ determined from the calculated abundance is found to be lower than 3 in all the observed cloud regions, although both the statistical ratio and the thermal equilibrium ratio at the dust temperature of 10K are predicted to be 3. The deviation of the O/P ratio of c-C$_3$H$_2$ from 3 indicates that the O/P ratio of the precursor molecule c-C$_3$H$_3^+$ is also different from its statistical ratio. Since the precursor molecule c-C$_3$H$_3^+$ is believed to be produced mainly by the reaction of C$_3$H$^+$ + H$_2$, the deviation may be a result of the lower O/P ratio of H$_2$ molecules than the statistical value in the observed regions. We will discuss details of the observed data and its analysis.