DETECTIONS OF LONG CARBON CHAINS CH_3CCCCH, C_6H, LINEAR-C_6H_2 AND C_7H IN THE LOW-MASS STAR FORMING REGION L1527

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Carbon chains in the warm carbon chain chemistry (WCCC) region has been searched in the 42–44 GHz region by using Green Bank 100 m telescope. Long carbon chains C_7H, C_6H, CH_3CCCCH, and linear-C_6H_2 and cyclic species C_3H and C_3H_2O have been detected in the low-mass star forming region L1527, performing the WCCC. C_7H was detected for the first time in molecular clouds. The column density of C_7H is derived to be 6.2×10^{10} cm^{-2} by using the detected $J =$ 24.5–23.5 and 25.5–24.5 rotational lines. The $^2\Pi_{1/2}$ electronic state of C_6H, locating 21.6 K above the $^2\Pi_{3/2}$ electronic ground state, and the $K_a = 0$ line of the para species of linear-C_6H_2 were also detected firstly in molecular clouds. The column densities of the $^2\Pi_{1/2}$ and $^2\Pi_{3/2}$ states of C_6H in L1527 were derived to be 1.6×10^{11} and 1.1×10^{12} cm^{-2}, respectively. The total column density of linear-C_6H_2 is obtained to be 1.86×10^{11} cm^{-2}. While the abundance ratios of carbon chains in between L1527 and the starless dark cloud Taurus Molecular Cloud-1 Cyanopolyyne Peak (TMC-1 CP) have a trend of decrease by extension of carbon-chain length, column densities of CH_3CCCCH and C_6H are on the trend. However, the column densities of linear-C_6H_2, and C_7H are as abundant as those of TMC-1 CP in spite of long carbon chain, i.e., they are not on the trend. The abundances of linear-C_6H_2 and C_7H show that L1527 is rich for long carbon chains as well as TMC-1 CP.