The precise determination of the ^{13}C isotopic ratios for carbon chain molecule HC_3N in the low-mass star forming region L1527 by radio observations

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Linear carbon chains have been found in dark clouds. Recently a lot of carbon chains have also been detected in the class 0 object L1527, which is a low-mass star forming region. We observed the normal and isotopic species of the fundamental carbon-chain molecule HC_3N in L1527 with the high signal-to-noise ratios using Green Bank 100 m telescope and Nobeyama 45 m telescope to explore the production scheme of HC_3N in the region having a warm carbon chain chemistry (WCCC). The spectral lines of the rotational transitions in the 44–109 GHz region were used to study the abundances of the normal and isotopic species. The ratios were precisely determined to be 1.00 : 1.01 ±0.03 : 1.35 ±0.04 : 86.4 ±2.2 for [$H^{13}CCCN$] : [$HC^{13}CCN$] : [$HCC^{13}CN$] : [HCCCN], where the errors are in one standard deviations. The ratios of [$HCC^{13}CN$]/[$HCCC^{15}N$] and [HCCCN]/[$HCCC^{15}N$] were obtained to be 5.26 ±0.24 and 338 ±15, respectively. It was found that the abundance of $H^{13}CCCN$ is almost equal to that of $HC^{13}CCN$, and it was concluded that HC_3N in L1527 is mainly formed by the reaction schemes *via* C_2H_2 and $C_2H_2^+$, *i.e.* dicarbide chemistry. The obtained ratios are quite similar to those reported in the cyanopolyyne peak in the starless dark cloud Taurus Molecular Cloud-1 [2]. Thus this similarity would suggest a universality of dicarbide chemistry producing HC_3N irrespective of evolutional phases from a starless dark cloud to a class 0 object for a low-mass star forming region.
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