Q32b Formation Mechanisms of HC_5N in TMC-1 as Studied by ^{13}C Isotopic Fractionation

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More than 180 molecules have been detected in the interstellar medium and circumstellar shells so far, and about 40% of them are classified into carbon-chain molecules. So, it is of fundamental importance for astrochemistry to study carbon-chain molecules. Current understanding of their formation mechanisms is still far from complete. Recently, the formation mechanisms of some representative carbon-chain molecules including HC_3N, which is the shortest of cyanopolyynes ($HC_{2n+1}N$; n=1,2,3...), have been investigated by observing their ^{13}C isotopic fractionation.

In order to investigate possible formation mechanisms of HC_5N, the second shortest of cyanopolyynes, we have carried out observations of normal species and five ^{13}C isotopologues of HC_5N using the $J = 16$-15 transition in the 42 GHz region toward the cyanopolyyne peak in Taurus Molecular Cloud-1, in 2014 March and April. We used the NRO 45-m radio telescope with the Z45 receiver. We found that there is no significant difference in the abundances among the five ^{13}C isotopologues of HC_5N. From these results, we discuss possible formation pathways of HC_5N and propose new ones. We conclude that HC_5N is not mainly formed from HC_3N, which was considered as one of the most possible pathways. This means that carbon-chain molecules may not have completely systematic formation pathways even though their structures are similar.