Chemistry of Cyanopolyynes in Hot Core Regions


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Cyanopolyynes (HC_{2n+1}N; n=1-5) are one of the representative series of carbon-chain molecules. Carbon-chain molecules are good indicators of starless and star-forming cores; carbon-chain molecules are abundant in young starless cores and decrease as progress of the star formation processes. However, two low-mass star forming cores where various carbon-chain molecules are abundant were discovered, and these regions were named Warm Carbon Chain Chemistry (WCCC) sources.

On the other hand, there are few studies about carbon-chain molecules in high-mass star-forming regions, and our understanding is poor. We then carried out observations toward hot cores with the Nobeyama 45-m radio telescope, the Green Bank 100-m telescope, and the Very Large Array (VLA) in order to study chemical mechanisms of carbon-chain molecules in hot core regions.

We derived 13C isotopic fractionation of HC3N toward G28.28-0.36 by observations of the three 13C isotopologues with the Nobeyama 45-m telescope. The abundance ratios are found to be 1.0±(0.1:1.00:1.47±0.17) for [H13CCC(N)] : [HC13CC] : [HCC13CN]. The observational results imply that the neutral-neutral reaction between C2H2 and CN overwhelms other formation pathways, which is consistent with the chemical model calculation.

We also detected HC5N toward 2 hot cores, G28.28-0.36 and G12.89+0.49, with the Green Bank 100-m telescope at the time of writing the abstract (Figure 1). Our high-spatial-resolution maps with the VLA toward G28.28-0.36 show that the spatial distributions of cyanopolyynes (HC3N, HC5N, and HC7N) are similar to that of CH3CN, which is a hot core tracer. Based on these observational results, we consider that there is a possibility that cyanopolyynes can be efficiently formed in hot core regions.

References