P149a Vibrationally-excited Lines of HC_3N Tracing the Disk Structure around the G 24.78+0.08 A1 Hyper-compact H_{II} Region

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We have analyzed ALMA Band 6 data toward the G 24.78+0.08 A1 hyper-compact H_{II} region (hereafter G 24), and report detection of vibrationally-excited lines of HC_3N ($v_7 = 2$, $J = 24 - 23$) that trace the disk structure around this massive protostar. The spatial distribution and kinematics of the HC_3N ($v_7 = 2$, $J = 24 - 23$, $l = 2e$) line are found to be similar to those of the CH_3CN vibrationally-excited lines ($v_8 = 1$). We derived the $^{13}CH_3CH/HC^{13}CCN$ abundance ratios in this source and compared them to the CH_3CN/HC_3N abundance ratios in Herbig Ae and T Tauri stars. The $^{13}CH_3CH/HC^{13}CCN$ ratios in G 24 are higher than the CH_3CN/HC_3N ratios in the other disks by more than one order of magnitude. The high CH_3CN/HC_3N ratios in G 24 suggest thermal desorption of CH_3CN in hot dense gas and efficient destruction of HC_3N in the region irradiated by the strong UV radiation. These results indicate that the HC_3N lines can be used as a disk tracer of massive protostars, and these nitrile species will be a good indicator for physical conditions of the disk structures. Finally, based on the two peaks seen in the free-free emission and the H30α recombination line, we briefly discussed the possibility that the central ionizing source of G 24 is composed of a binary.