Complex organic molecules detected in twelve high mass star forming regions with ALMA

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Recent astrochemical models and experiments have explained that complex organic molecules (COMs; molecules composed of six or more atoms) are produced on the dust grain mantles in cold and dense gas in prestellar cores [1]. However, the chemical networks and the roles of physical conditions on chemistry are not still understood well. To address this question, hot cores in high mass young stellar objects are great laboratories due to their strong emissions and larger samples than those of low-mass counterparts. In addition, CH_3OH masers, which have been mostly found in high mass star forming regions, can provide constraints due to their very specific emerging conditions. We investigate the chemical diversity in richness and complexity of twelve high mass star forming regions using the ALMA band 6 observations. They are associated with 44/95 GHz class I and 6.7 GHz class II CH_3OH masers, implying that the active accretion processes are ongoing [2][3]. For these previously unresolved regions, 63 continuum peaks are detected. Among them, we found 28 cores emitting COMs and specified 10 cores associated with 6.7 GHz Class II CH_3OH masers. We identified up to 19 COMs including oxygen- and nitrogen-bearing molecules and their isotopologues in a core and derived their abundances. We found that (1) oxygen-bearing molecules appear to be richer in abundance and more complex in molecular structures than those of nitrogen-bearing species, (2) COMs detection rate steeply grows with the gas column density, above the threshold of $\sim 10^{24} cm^{-2}$, which can be attributed to the effective COMs formation in dense cores, and (3) cores associated with class II CH_3OH maser tend to emit larger number of COMs. Therefore, from our analysis, we conclude that the chemical diversity among hot cores could be originated by the degree of the accretion of each source as well as different physical conditions of cores.

References

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