ALMA Observations of Ethyl Formate toward Orion KL

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Orion KL is one of the prime templates of astrochemical and prebiotic chemical studies. We wish to explore more organic molecules with increasing complexity in this region. In particular, we have searched for one of the most complex organic molecules detected in space so far, ethyl formate (C 2 H 5 OCHO). This species is the next step in chemical complexity after the simplest member of esters (methyl formate, CH 3 OCHO). The mechanisms leading to its formation are still poorly known. We have used high angular resolution (?1.?5) ALMA observations covering a large bandwidth from 214 to 247 GHz. We have detected 82 unblended lines of C 2 H 5 OCHO (49 and 33 of the trans- and gauche-conformers, respectively). The line images showed that C 2 H 5 OCHO arises mainly from the compact ridge and the hot core-southwest regions. The derived rotational temperatures and column densities are 122 ± 34 K, (0.9 ± 0.3) × 10 16 cm -2 for the hot core-SW, and 103 ± 13 K, (0.6 ± 0.3) × 10 16 cm -2 for the compact ridge. The comparison of spatial distribution and abundance ratios with chemically related molecules (methyl formate, ethanol, and formic acid) indicates that C 2 H 5 OCHO is likely formed on the surface of dust grains by addition of CH 3 to functional-group radicals (CH 2 OCHO) derived from methyl formate (CH 3 OCHO).