

## Glyoxylate from CO atmosphere via UV photochemistry

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Glyoxylate could be an important compound, which can initiate a simple autocatalytic cycle and may possibly evolve to synthesize amino acids, nucleobase, pentose etc. (Eschenmoser, 2007a). However, constant supply of glyoxylate is an issue for the prebiotic environment. In this study, we aim to understand the possible condition to supply glyoxylate continuously to support such an autocatalytic cycle. First, we have performed experimental study and demonstrated that glyoxylic acid can be synthesized photochemically under carbon monoxide atmosphere. On the other hand, the UV irradiation into formaldehyde solution does not yield glyoxylic acid, except for the presence of CO in the gas phase. These results indicate that glyoxylate is not produced from formaldehyde in solution but from CO in the gas phase probably through the 3 steps: (i) HCO radical is produced from the reaction between CO and H from H<sub>2</sub>O photolysis; (ii) The HCO radical dimerize in the gas phase, to form (CHO)<sub>2</sub>(glyoxal); and (iii) The (CHO)<sub>2</sub> is oxidized into HCOCOOH (glyoxylate). An additional experiment demonstrated that UV irradiation into pure glyoxal solution can yield glyoxylate, and thus indicate that the step (iii) can proceed in the solution. Consequently, our experimental results suggests that glyoxylate can be continuously provided from atmosphere into hydrosphere if the atmosphere is rich in CO.

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