Non-Enzymatic RNA Hydrolysis Promoted by the Combined Catalytic Activity of Buffers and Magnesium Ions

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Z. Naturforsch. **54c,** 542–548 (1999); received January 20/March 23, 1999

RNA, RNA Degradation, RNA Hydrolysis, Acid-Base Catalysis, Magnesium Catalysis

Although Mg^{2+} is an important cofactor for the specific degradation of RNA by ribozymes, it is not considered as a typical chemical nuclease. In this study we show that in combination with common buffers such as tris(hydroxymethyl)aminomethane and sodium borate, Mg^{2+} is a powerful catalyst for the degradation of RNA. pH and temperature are found to be the principal factors for the efficient degradation of RNA. Whereas in Tris-HCl/Mg^{2+} the efficient cleavage starts at pH values higher than 7.5 and temperatures higher than 37 °C, in sodium borate RNA degradation begins at pH 7.0 and at 37 °C. RNA hydrolysis promoted under the combined catalytic activity of buffer/Mg^{2+} results in partially degraded RNA and negligible amounts of acid-soluble material. Reaction is insensitive to the concentration of monovalent cations but is completely prevented by chelating agents (EDTA and citrate) at concentrations exceeding that of Mg^{2+}. Borate-magnesium reaction is inhibited also by some polyvalent alcohols (glycerol) and sugars.