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

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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.