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COMPARATIVE THERMOGRAVIMETRIC COMPOSITIONAL ANALYSIS OF CRYSTALLINE YEAST RNA AND ITS SODIUM SALT IN DIFFERENT CONDITIONS

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Solid state samples of yeast ribonucleic acid (RNA) and its sodium salt (Na-RNA) have been studied by TGA and DTA using a standard test method ASTM E 1131-08 for compositional analysis by thermogravimetry. All the measurements were performed in nitrogen atmosphere at the heating rate of 20°C/min using Du Pont - 9900 instrument.

The data obtained reveals a similar thermal decomposition pathway for all the Na-RNA samples (1)–(10) except sample (9), which corresponds to the pure RNA (Fig. 1*a*). Below 200 °C the yield of volatiles was 15–20 mass% with the mass loss rate of 3.6–4.6 %/min. Between 200 and 500 °C thermal destruction of the samples occurs with the mass loss of 40–50% and the mass loss rate of 6.5–9 %/min with the temperature maximum of 295–300 °C. Above 500 °C a very low rate of pyrolysis (1.2–0.2 %/min) is observed.

For pure RNA sample (9) in the temperature range below 500 °C there are three distinct stages of thermal destruction with the maxima at 90 °C, 225 °C and 300 °C, and the corresponding thermal decomposition rates of 1.2, 2.8 and 4.5 %/min. Above 500 °C there is also a very low pyrolysis rate of 1.2–0.3 %/min. After changing the inert N₂ atmosphere to air, the carbonized fraction which differs in different samples undergoes oxidation with different rates (Fig. 1*b*). According to DTG curves, a different nature of the sample oxidation is observed at 800 °C.



Figure 1. a - TG(1) and DTG(2) curves of the initial RNA samples for compositional analysis; b - TG(1) and DTG(2) curves of carbonized RNA sample oxidation at 800 °C.

The difference in thermal decomposition behavior observed between RNA and Na-RNA samples in a solid state has been proved by NMR spectroscopy and scanning electron microscopy. The possible applications of the results obtained towards the problem of the origin of life and chemical evolution of biomacromolecules in prebiotic conditions (RNA world) are discussed.

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