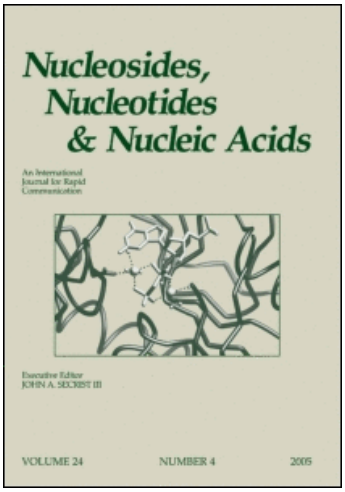

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ACIDIC HYDROLYSIS OF THE N-GLYCOSIDIC BONDS OF DEOXYRIBONUCLEIC ACID BY HYDROGEN FLUORIDE STABILIZED IN PYRIDINE

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Abstract. Hydrolysis of the N-glycosidic bonds of normal and modified DNAs as well as of model compounds was achieved by a mild approach involving the use of hydrogen fluoride in pyridine at room temperature.

Acidic hydrolysis of deoxyribonucleic acid (DNA) constitutes the usual way to obtain the quantitative release of the free purine and pyrimidine nucleobases. One of the most convenient approach involves the use of concentrated formic acid at high temperature (180°C) for 30 minutes to induce the complete release of the resistant thymine and cytosine bases. Similar conditions have been utilized for monitoring the formation of cyclobutadipyrimidines, an important class of photoproducts within naked and cellular DNA exposed to far-UV light [1]. However this experimental approach cannot be applied for the hydrolysis of radiation-induced modified nucleobases such as 5,6-dihydroxy-5,6-dihydrothymine and 5-hydroxymethyluracil. It should be noticed that the decomposition of these compounds is considerably reduced by lowering the temperature of hydrolysis (90°C) but this requires an important increase of the reaction time [2]

We would like to propose the use of hydrogen fluoride stabilized in pyridine as a mild and more convenient alternative to formic acid.

Materials and Methods.

HF-pyridine hydrolysis. The acidic hydrolysis is carried out at room temperature on dried substrates (DNA and model compounds) in siliconized polypropylene tubes. The reaction is stopped by quenching HF with 0.3 M sodium acetate in ethanol at - 20°C.

Results and discussion.

Hydrogen fluoride acid hydrolysis of unmodified DNA and nucleotides. Mechanistic aspects of the hydrogen fluoride hydrolysis of normal nucleotides and DNA have been inferred from kinetic experiments. It has been observed that the cleavage of the phosphomono(di)ester bond(s) is taking place concurrently with the hydrolysis of the N-glycosidic bond. This is agreement with previous observations which showed that the action of hydrogen fluoride,both liquid and aqueous, on mononucleotides is specific leading preferentially to phosphorus-oxygen, rather than carbon-oxygen, bond cleavage [3].It should also be mentioned that deamination which is observed under the drastic conditions of formic acid hydrolysis is not detected under the present hydrogen fluoride conditions.

Acidic hydrolysis of radiation- and photo-induced modified DNAs and nucleosides. Attempts have been made to apply this mild hydrolytic assay for the measurement of modified nucleobases within DNA and nucleosides. Model experiments involving 2'-deoxyguanosine have revealed that the release of the corresponding free bases moiety of the nucleosides takes place quantitatively within one minute. It is worth noting that under a longer period of exposure to HF up to 30 min no detectable decomposition of the 8-hydroxylated derivative of guanine was observed. This will allow the use of this approach to search for the formation of these nucleobases by the highly sensitive electrochemical detection method. The quantitative release of the thymine diol from the corresponding 2'-deoxyribonucleosides was found to require a higher period of time (15 min). It is interesting to note that the main products of the reaction were found to be the cis and trans isomers of 5-ethoxy-6-hydroxy-5,6-dihydrothymine. Other example of application of this mild hydrolytic method dealt with the quantitative release of the cis-syn cyclobutadithymine and 5-hydroxy-6-4'-(pyrimidin-2'-one)-5,6-dihydrothymine from far-UV irradiated DNA [4].

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