Effect Hypochlorite on Structure of Nucleic Acids

Daria N. Osinnikova, Kristina I Pavlova, Alexander M. Polyanichko, Evgenia B. Moroshkina

St. Petersburg State University, St. Petersburg, Russia

One of the greatest challenges in the treatment of infectious diseases is to overcome the resistance developing by bacteria in respond to the antimicrobial drugs. There are a lot of antiseptic agents targeted at nucleic acids and proteins to ensure the destruction of bacteria and viruses. Among them one of the most relevant to practice is sodium hypochlorite (NaClO). It is widely used in medicine, food industry and agriculture as a bactericidal and sterilizing agent with no bacterial resistance documented so far.

In living cells, sodium hypochlorite reacts with various biological molecules, including nucleic acids (NAs), proteins and lipids. It has been shown earlier that the interaction of the hypochlorite with individual nitrogenous bases at the first stage leads to their chlorination with the formation of various chloramines and radicals.

In this work, we study the interaction of sodium hypochlorite with various DNA and RNA samples from individual nucleotides and synthetic single stranded polynucleotides to natural double stranded DNA using UV and FTIR spectroscopy. The spectroscopic data obtained suggest that the NaClO interacts more effectively with NA possessing secondary structure, compared to individual nucleotides. It has been demonstrated, that interaction of the NaClO with dsNA resulted in denaturation of NA is followed by modification of the nitrogenous based and degradation of the sugar-phosphate backbone. Analysis if the spectra revealed that the reaction between hypochlorite and NA depends not only on the particular secondary structure, but also on the nucleotide composition of NAs.

Part of the work was performed using the equipment of the Research Park of St. Petersburg State University ("Centre for Optical and Laser Materials Research", "Centre for Diagnostics of Functional Materials for Medicine, Pharmacology and Nanoelectronics", "Cryogenic Department").