Possible ways of recycling quinolone antibiotics

Possible ways of recycling quinolone antibiotics

A.V. Polishchuk , E.T. Karaseva, V.E. Karasev

Institute of Chemistry, Far-Eastern Branch of the Russian Academy of Sciences, Russia

Introduction. Quinolones are a large and constantly expanding group of antibiotics. These compounds are widely used in human therapy, as well as in veterinary medicine, for treatment, prophylaxis, and as growth promoters. The use of the drugs in veterinary applications can leave residues in edible animal tissues, which may be directly toxic or cause resistant human pathogens and possible allergic hypersensitivity reactions in humans. Different sea foods can accumulate residues of quinolone antibacterials from water. Tons of medicines are prescribed each year, but it is not known what happens to those compounds after they are excreted. Most countries have regulatory agencies explicitly charged with protecting the environment from pesticides and other potentially toxic industrial chemicals. Drugs, however, have come to be regulated by health departments, which possess little expertise in protecting natural ecosystems and water supplies. Moreover, they tend not to look at pharmaceuticals as potential pollutants - even though up to 90 percent of a delivered drug may leave the body in urine and feces. Thus, the establishment of sensitive methods is required in order to control these drugs in the environment. The development of methods for drugs rational utilization is Also very important.

Methods. Spectroscopic: emission spectra, electronic UV absorption spectra, IR spectra, elemental chemical analysis, atomic-absorption, thermal analysis, X-ray.

Results. Fluoroquinolones form luminescent complexes with Rare Earth Ions at pH 7-8. The structure and composition of the complexes was investigated. All complexes have strong ion emission with the Stark structure of spectra. The complexes were investigated as polymer materials "Polisvetan" activators, used in agriculture for promoting plant growth. The luminescence intensity, compatibility with the polymer material, and photostability of these complexes were better than those used in polymer production. Also we investigated the luminescence and photochemical properties of different quinolone antibiotics in order to develop methods for their determination in the environment. For example, we designed a simple and selective luminescent method for the identification and simultaneous determination of quinolones with close compositions and structures: norfoxacin (nfqH) and ciprofloxacin (cfqH), using the Stark structure of their emission spectra.

Discussion. Rare-earth ions show unique fluorescent properties when complexed with fluoroquinolones. The strong ion emission of these complexes originates from an intrachelate energy transfer from the triplet state of the ligand to the excited energy levels of the lanthanide ion. Moreover, the Stark structures of the spectra are very unique for each of the ion complexes with fluoroquinolones. Methods for the selective and sensitive determination of fluoroquinolones, which serve as energy donors to lanthanides, can be developed on the basis of the specific luminescent properties of some rare-earth ions. The utilization of fluoroquinolones as polymer films activators can also facilitate their recycling, for example, in agriculture.