X-ray Examination of the Complex Adenosine with $\text{UO}_2^{2+}$ and $\text{Th}^{4+}$ Ions

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Abstract: The authors studied the interaction of dioxouranium (VI) $\text{UO}_2^{2+}$ and thorium $\text{Th}^{4+}$ ions with ATP (5'-adenosine 5'-triphosphate) and obtained a complex of adenosine with uranium $\text{UO}_2^{2+}$ and thorium $\text{Th}^{4+}$ ions and used X-ray method to explore these complexes.

Key words: Complex Adenosine, dioxouranium $\text{UO}_2^{2+}$, $\text{Th}^{4+}$ ions, X-ray.

1. Introduction

Metal complex formation of nucleotides is well documented, as well as its biological importance. Metal-nucleotide complex may act as cofactor, substrate or modifier in promoting enzymatic catalysis of displacement reactions of phosphorus and maintaining structural integrity and specificity of nucleic acids. Nucleotides bind metal through three potential binding sites: phosphate groups, sugar hydroxo groups and ring nitrogen of base [1-12].

The purpose of this work is to obtain a complex of adenosine with uranium $\text{UO}_2^{2+}$ and thorium $\text{Th}^{4+}$ ions by using X-ray method to explore these complexes as potential anticancer drugs in medicine.

2. Experimental Sections

Dioxouranium (VI) ($\text{UO}_2^{2+}$) and thorium ($\text{Th}^{4+}$) cations were used as nitrate salts. ADP (adenosine 5'-diphosphate) was used as disodium salt.

3. Results and Discussion

Stefano et al. [1] has studied interaction of dioxouranium (VI) (uranyl) ion with ATP (5'-adenosine 5'-triphosphate) and the effect of ligand/proton and metal/hydroxide displacement, at very low ionic strength and at $I = 0.15 \text{ mol·L}^{-1}$, in aqueous Me$_4$NCl and NaCl solutions, at $t = 25 ^\circ\text{C}$.

The interaction of adenosine with uranyl ions is described by the Eq. (1):

$$p\text{UO}_2^{2+} + q(\text{ATP}^{4-}) + r\text{H}^+ \rightarrow (\text{UO}_2)^p(\text{ATP})_q\text{H}^{(2p - 4q + r)}$$

Analysis of the complex of adenosine with uranium $\text{UO}_2^{2+}$ and thorium $\text{Th}^{4+}$ ions was performed by X-ray microanalysis. Instrument: electron probe microanalyzer. Brand: Superprobe 733, Japan Electron Optics Laboratories, Japan.

The analysis of the elemental composition of the resulting of the Microsphere Magnetic Catalyst with salts of Thorium and of Uranium was performed using energy-dispersive spectrometer Energy Oxford Instruments, England, established by electron probe microanalyzer Superprobe 733 at an accelerating voltage of 25 kV and a probe current of 25 nA.

Figs. 1 and 2 show the laboratory unit and X-ray spectrum of the complex Adenosine with $\text{UO}_2^{2+}$ and $\text{Th}^{4+}$.

Table 1 shows the elemental composition of the complex Adenosine with uranium ($\text{UO}_2^{2+}$) and thorium ($\text{Th}^{4+}$) ions.
Table 1  Elemental composition of the complex Adenosine with UO$_2^{2+}$ and Th$^{4+}$ ions.

<table>
<thead>
<tr>
<th>Element</th>
<th>C</th>
<th>H</th>
<th>O</th>
<th>N</th>
<th>P</th>
<th>Na</th>
<th>Th</th>
<th>U</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit (%)</td>
<td>14.3</td>
<td>1.9</td>
<td>40.1</td>
<td>11.7</td>
<td>11.1</td>
<td>5.2</td>
<td>0.10</td>
<td>28.4</td>
</tr>
</tbody>
</table>

Fig. 1  Obtain a complex of adenosine with UO$_2^{2+}$ and Th$^{4+}$.

Fig. 2  X-ray spectrum of the complex Adenosine with UO$_2^{2+}$ and Th$^{4+}$.
Thus, the authors obtained a complex of adenosine with uranium UO$_2^{2+}$ and thorium Th$^{4+}$ ions, and used X-ray method to explore these complexes.

4. Conclusions

The authors obtained a complex of adenosine with uranium UO$_2^{2+}$ and thorium Th$^{4+}$ ions and used X-ray method to explore these complexes.

The proposed new method of synthesis potential of organic complexes of uranium and thorium can open new horizons to expand the potential application of biologically active substances of actinides and pharmaceuticals preparations.

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References


