Electrochemical, spectroelectrochemical and electrochromic properties of new donor-acceptor type derivatives of flavanthrone

Dyes have accompanied our civilization since the beginning of mankind. Their role in the fine arts and in improving esthetics of the surrounding world cannot be everestimated. Up to the end of XIX century, the majority of dyes were of natural origin. Indigo dye is a good example here. Increasing industrial demand for this blue vegetal-origin dye and other natural dyes of different colors, stimulated extensive progress in the organic chemistry at the end of XIX century which resulted in the preparation of several synthetic dyes, frequently much cheaper than the natural ones. This research gave rise to a new group of synthetic dyes used in textile industry, the so called “vat dyes”. Indanthrone and flavanthrone - popular dyes at those times, became nowadays almost forgotten, because of the technological changes which eliminated them from the industrial processes.

Both indanthrone and flavanthrone are insoluble which is somehow disadvantageous if other than textile coloring applications are considered. In our preliminary studies we have shown that both dyes can be converted into soluble compounds, which in addition to semiconducting properties, exhibit strong electroluminescence *i.e.* they shine light when electrical current is passed.

This project is devoted only to these new derivatives of flavanthrone and it does not refer to their electroluminescent properties but to peculiar optical and electrochemical properties of these compounds as well as to their electrochromism. Electrochromism is a phenomenon involving a change of colour in a given material as a result of chemical processes induced by the flow of current. Our preliminary investigations show that the new flavanthrone derivatives are very good candidates for electrochromic materials. We want to prepare such derivatives which can be electrically switched between transparent and coloured states. This, in our opinion, can be achieved if special groups are attached to the conjugated flavanthrone core such as triphenylamine or carbazole. Special interactions between the flavanthrone core and these groups, called “substituents”, profoundly influence the color of the molecule and facilitate its electrical switching to other colours or to a transparent (colourless) state.

In addition to this practical goal, we want to elucidate the mechanism of the reactions leading to the colour changes. To achieve this goal we are planning to study the electrochemical processes in different solvents: i) aprotic *i.e.* solvents which cannot exchange protons with the studied molecule; ii) protic *i.e.* solvents which can exchange protons with the studied molecules and iii) aprotic with admixture of a protonating agent *i.e.* a chemical compound readily transfers its proton to the molecule. Based on our preliminary results we can state that the type of the solvent allows for additional tuning of colors and color switching potentials.