Kropelnytska Yu.V.

LIGHT-SENSITIVE MATERIALS BASED ON TiO_2 AND THE MEROCYANINE POLYMETHINE DYE

Department of Medical and Pharmaceutical Chemistry
Bukovinian State Medical University

Semiconducting materials exhibiting some photocatalytic properties are regarded as important among functional materials due to their being a basis for new light-sensitive systems for solar energy conversion and accumulation, toxic waste decontamination, development of non-traditional methods of low-tonnage synthesis of valuable substances, etc. However, low coefficient of performance of light usage and insufficient quantum yields of photoprocesses are hindering wider application of these materials. That is why the search for light-sensitive semiconducting materials with advanced light conversion characteristics, including those exhibiting activity within the near-IR range, is a high-priority scientific direction. In order to eliminate such a flaw, the idea was introduced for developing heterostructures (HS) that consist of a dye deposited on a semiconductor's surface in the right amount and protected by a polymer film, which prevents dissolution or washing-off of the dye and creates no obstacles during interphase electron transfer processes. Such HS have ensured high efficiency in the photocatalytic processes of water decomposition, restoration of methylene blue and oxidation of iodide ions.

Titanium (IV) oxide P25 (Degussa), a polymer polyepoxypropylcarbazole (P) and some merocyanine dyes were used to obtain a HS of the above mentioned type ($P/B/TiO_2$). The oxidation and restoration potentials of the dye were determined from cyclic voltammetry data and later on they were used to evaluate photocatalytic performance of the HS $P/B/TiO_2$ and to outline physical and chemical approaches to design new wide-range light-sensitive photocatalytic systems.

According to the general scheme of sensitization, the following stages are involved in the process: dye photoexcitation, electron transfer from the triplet state into the conductivity band of the semiconductor and dye regeneration occurring in the solution through capturing of an electron by a cation-radical formed previously at the initial stage of the process.

LUMO and HOMO energy values of the dyes have been calculated using spectral and electrochemical data. Afterwards, these values were used to analyze the processes that may occur in suspensions and HS being exposed to the light. Then energy diagrams of energy levels configuration in relation to the electrical-physical characteristics of titanium (IV) oxide have been built using the determined oxidation and restoration potentials of the dyes. As seen from the diagrams analysis, the oxidation potentials of the electron-excited molecules (LUMO energy level) of the dyes-sensitizers are located higher than the upper edge of the TiO_2 conductivity band. It means that the process of electron injection into the TiO_2 conductivity band is thermodynamically allowed and, therefore, the researched dyes can in fact sensitize the semiconductor.

Kushnir O.Yu.

INFLUENCE OF MELATONIN ON AGE-RELATED CHANGES OF PYRUVATE KINASE ACTIVITY IN THE BLOOD OF ALLOXAN DIABETIC RATS

Department of Bioorganic and Biological Chemistry and Clinical Biochemistry
Bukovinian State Medical University

Melatonin (N-acetyl-5-methoxytryptamine) is the major product of the pineal gland, which functions as a regulator of sleep, circadian rhythm, and immune function.

Aging is characterized by a progressive deterioration in physiological functions and metabolic processes. The loss of cells in vital tissues and organs during aging is related to several factors including oxidative stress and inflammation.

Oxygen free radicals of mitochondrial origin seem to be involved in aging. Available studies are consistent with the possibility that oxygen radicals endogenously produced by mitochondria are causally involved in the determination of the rate of aging in homeothermic vertebrates. Oxidative damage to tissue macromolecules seems to increase during aging. The rate of mitochondrial oxygen radical generation of post-mitotic tissues is negatively correlated with animal longevity.