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Applicability of electrolysis for artificial blood purification

Hemodialysis and peritoneal dialysis are the two main methods of renal replacement therapy. Several teams around the world are developing and testing a prototype of wearable artificial kidney (WAK), the central component of which is the dialysis regeneration unit (DRU). Its task is to restore the initial physical and chemical state of the dialysate solution. The main markers of the therapy effectiveness are the concentrations of creatinine, uric acid and urea. The first two substances are easily removed with activated carbon, but for urea elimination, it is necessary to use special methods: enzymatic or electrochemical. The enzymatic method uses urease, which catalyzes the hydrolysis of urea to carbon dioxide and ammonia, which are subsequently adsorbed by activated carbon. The disadvantage of this method is the complexity of manufacturing and storing urease. In the electrochemical method, electrolysis of waste dialysate is used in an electrochemical cell. The key complexity of this method is the selection of a method for the long-term and controlled removal of urea from spent dialysate. Urea can be electrochemically oxidized in a neutral medium using catalysts made of platinum group metals such as Ru-TiO_2, Ti-Pt, Ti-(Pt-Ir), or from carbon materials such as coal, carbon foam, graphite, etc. In this work, electrodes made of various materials are studied to evaluate the applicability of their use as part of an electrochemical regenerator in WAK. Among the materials studied were platinum deposited on titanium by electrodeposition and by the blasting; rhodium, deposited on titanium by electrodeposition; ruthenium deposited on titanium by electrodeposition method, as well as electrodes from foamed coal; silicon-carbon films deposited on titanium substrates by vacuum spraying, doped with molybdenum; silicon-diamond films deposited on titanium substrates; platinum, sputtered on titanium substrates.

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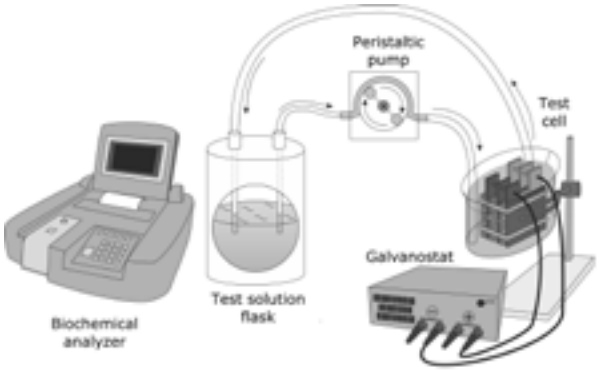

Biography

Nikolai Bazaev has completed his PhD at the age of 27 years from National Research University MIET, Russia. He is the chief executive for wearable artificial kidney and artificial pancreas projects. He has published more than 30 papers in peer-reviewed journals.

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