Extracorporeal Blood Purification by utilization of Porous Adsorption Material

By

NG, Yik Wong

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Examination Committee:
Prof. Minhua SHAO, Chairman
Prof. Tom LUO, Supervisor
Prof. Fei SUN

Abstract

Renal failure has been being concerned for serval decades. Over the world, more than one million people die annually due to End Stage Kidney Disease (ESKD) that is the ultimate and the worst stage of kidney disease, in which the functions of patients’ kidneys have been completely lost. Acute Kidney Injury (AKI) and Chronic Kidney Disease (CKD) are most common among different kinds of kidney disease, where CKD has been concerned most due to its incurability. The current treatments for CKD are mainly kidney transplantation and dialysis. Up to now, kidney transplantation is considered as the best treatment for CKD, as the patients are allowed to have better quality of life after the operation among all the current treatments. Yet, the availability of the kidney source has brought a great challenge towards the operation, and thus one may resort to dialysis that allows the material exchanging via a semi – permeable membrane under the concentration gradient between patients’ blood and the dialysis fluid. Worse still, dialysis, hemodialysis (HD) in particular, is a relatively inconvenient treatment due to the frequent and time – consuming process, which may highly affect the quality of life of the patient. On the other hand, patients may also suffer from the cost for receiving dialysis treatment due to the operation cost and the continuous supply in the long run. Therefore, some alternatives for HD have been being proposed. Hemoperfusion (HP), which removes the uremic toxins by means of adsorption, has attracted many attention again recently. With the faster and cheaper treatment, HP has shown the great potential in the blood purification aspect in the future, such as the development of wearable artificial kidney. In this study, the details of designing a HP cartridge has been studied. With porous polystyrene (PS) beads as the starting materials, different kinds of adsorbents have been synthesized. With some characterization techniques, such as FTIR and XPS, the successful synthesis of the adsorbents are confirmed. With the aid of UV – Vis spectroscopy, the performance of the adsorbents towards different major uremic toxins, such as creatinine, uric acid, bilirubin and bile acid are investigated. Besides, the test that studies the adhesion of platelet on the adsorbents has also provided the preliminary idea for the hemocompatibility for the adsorbents. Some of the results have been compared with the commercial product HA130 hemoperfusion cartridge from Jafron Biomedical Co., Ltd for seeking the room of improvement.