Hyperphosphatemia is an important therapeutic problem in patients undergoing hemodialysis (HD), especially as it is an important risk factor for mortality. Along with the hormonal changes induced by it, leads to profound changes in the cardiovascular system (with its calcification), inducts bone disease and it is impaired with functioning of other systems of the body. Diet and pharmacological therapies are used to prevent hyperphosphatemia. Too much dietary phosphate limitation is both cumbersome and dangerous for the patient, as it is associated with a risk of protein deficiency and malnutrition. On the other hand, pharmaceuticals that bind phosphorus in the digestive system are an additional burden on the liver and digestive system.

The effectiveness of phosphate removal in standard hemodialysis is also small. While phosphates in the course of hemodialysis are easily removed from the patient's blood, much of that is sequestered in the muscle. Removal of phosphate from intracellular compartment is possible, but results in an extended dialysis time.

During the hemodialysis procedure, blood phosphate levels drops rapidly to a certain level in the first hour of dialysis, and then slowly approach the plateau in last two hours. On the other hand, after dialysis, the *rebound* occurs, which involves releasing phosphates from the muscles when the body is back to an acid-base balance.

In addition, the inhibitory factor for phosphate removal from the muscle pool is alkalosis (excessive blood pH elevation) that occurs at the end of treatment due to the long exposure of the blood to dialysis fluid. The main component of dialysis fluid is bicarbonate buffer. The alkalosis at the end of the dialysis session is, in spite of appearances, unpredictable. It is in many ways a disadvantage, although the effects have not been sufficiently investigated. It is possible to prevent excessive alkalosis by reducing the concentration of bicarbonate in the dialysis fluid. On one hand, this will prevent alkalosis, but on the other, it may cause in incomplete metabolic acidosis reduction. Perhaps it would be beneficial to change the carbonate concentration during dialysis: higher at the beginning and lower at the end or vice versa. It is difficult to predict the effects of such a procedure. In theory, increasing concentrations of carbonates will keep the gradient through the dialyzer membrane, but on the other hand can cause alkalosis and retention of phosphate removal from the muscle pool at the end. Otherwise, decreasing concentration of carbonates aims to keep the gradient at the initial time of procedure and prevent alkalosis at the end of dialysis. In addition, the determination of the total amount of phosphate removed on the basis of serum samples during and after the procedure does not provide reliable information because, in the case of phosphates, the rebound occurs after dialysis.

It is possible to reliably determine the total amount of phosphate removed by monitoring their concentration in the fluid leaving the artificial kidney. The post dialysis fluid can be sampled at minute intervals, and the phosphate concentration can be determined. Based on the operating parameters of the artificial kidney (dialysis fluid flow rate through the dialyzer) the total amount of toxin removed can be determined with ease and accurately. Furthermore, concentration in function of time of dialysis can show dynamics of the toxin removal. Correlation of this information to the carbonate concentration profile generated by the dialyzer will determine the effect of carbonate concentration on the phosphate removal dynamics.
The research will be conducted in co-operation between two academic centers - the Faculty of Chemistry of the University of Warsaw, which will be responsible for determination of phosphate levels in the fluid leaving the artificial kidney and the Department of Nephrology, dialysis and internal diseases of the Medical University of Warsaw. Additionally, effects of bicarbonate profiling on phosphate concentration and other parameters such as blood pH, pO_2, pCO_2, calcium, lactate, potassium and magnesium levels during hemodialysis and one hour after hemodialysis session will be investigated.