

105f Advances in Hemodialysis Applications

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Hemodialysis is the process by which patients with renal failure have their blood filtered in an artificial kidney. The typical artificial kidney contains approximately 10,000 hollow fiber membranes, with a combined surface area of 1 to 2 square meters. Hollow fiber hemodialysis membranes have comprised the largest segment of the membrane market for many years. This paper will review the state of the art in dialysis membranes as well as other aspects of operation of interest to chemical engineers.

Two particular areas that will be covered will be artificial kidney reuse and the use of dialysate filters. For many years, the practice of dialyzer reuse has been common in the United States. (A dialyzer is reused on the same patient, not on different patients.) While dialyzer reuse initially offered the advantage of improving the biocompatibility of the membrane surface, at the expense of potentially reduced mass transport, this balance has changed due to increased biocompatibility of membranes. Recently published data suggests a possible mortality benefit with eliminating reuse.

Hemodialysis patients are typically exposed to large volumes (>100L) of non-sterile dialysate solution three times a week. Today's high-flux dialysis membranes, tailored to allow removal of middle-molecular toxins from the blood, allow back-transport of similarly sized endotoxin fragments from dialysate to blood. Exposure to such bacterial products has been associated with chronic inflammation and its sequelae. The purpose of this study was to determine whether disposable Diasafe™ endotoxin filters allow achievement of a proposed new standard for dialysate endotoxin levels without changes to the existing water treatment systems. We measured dialysate endotoxin levels using a 0.06 EU/ml sensitivity gel clot LAL assay in 503 dialysis machines in 20 randomly selected dialysis facilities (mean 25.15 ± 9.04, median 23.5 machines/facility). Resulting endotoxin levels were 16-fold lower than the proposed dialysate action threshold and surpassed the proposed AAMI endotoxin standard of < 0.25 EU/ml for over 98.5% of machines tested.