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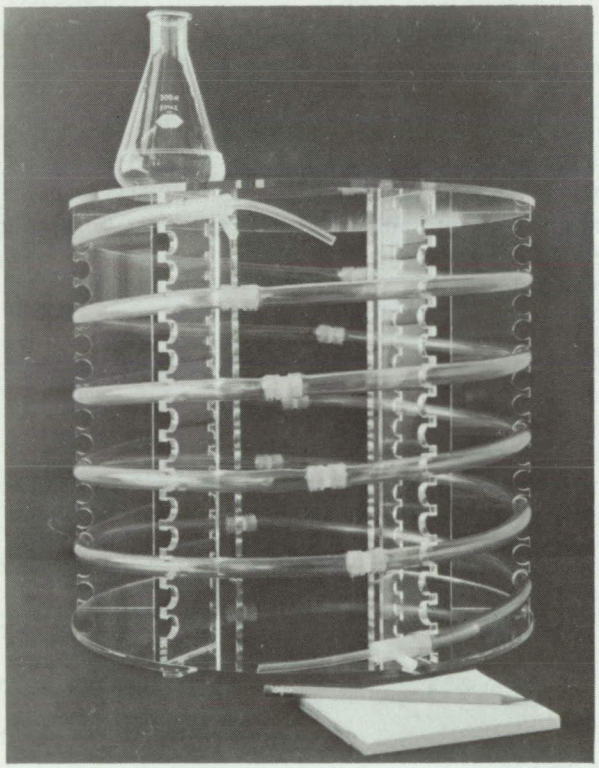
# NASA TECH BRIEF



## Large Volume Continuous Counterflow Dialyzer Has High Efficiency



### The problem:

In biochemical research, the need often arises to separate by dialysis, macromolecules (proteins and nucleic acids) from small molecules (salts, urea, glucose) in large volumes of solution (extracts of biological material, blood, serum). The conventional method of dialysis consists of filling a cellophane sac with the solution to be dialyzed and then suspending the sac in a bath to permit equilibration of the small dialyzable solutes inside the sac with the solution in the bath; macromolecules cannot pass through the sac. The efficiency of this process depends mainly on the ratio of dialysis sac area/volume of liquid in the sac, and the concentration in the bath. Ordinarily dialysis baths are refreshed four or five times a day and the dialysis sacs are agitated by some mechanical means. In instances where large volumes of solution need to be dialyzed, the procedure is time consuming and inconvenient.

(continued overleaf)

**The solution:**

A dialyzer design that takes advantage of the high area/volume ratio in commercially available 1/4-inch dialysis tubing and maintains a high concentration gradient at the dialyzing surface by counterflow.

**How it's done:**

The dialyzer consists of an inner dialysis tube (through which the solution to be dialyzed, *the retentate*, flows) concentric with an outer vinyl tube (through which the bath fluid, *the diffusate*, flows). The inner dialysis tube is held in place by plastic spacers at 2-foot intervals to minimize kinking and facilitate assembly. This dialyzer coil is extended 20 or 30 feet, and is terminated at each end with a plastic connector with tubulature that permits separate inflow and outflow of retentate and diffusate. A dialysis coil constructed in this way can utilize the counterflow of retentate and diffusate to maintain a uniformly high concentration gradient. The flow of retentate and diffusate is turbulent, thus aiding in maintaining a maximum concentration gradient at the membrane surfaces. The flow of the diffusate is continuous, eliminating the need to change baths, and the retentate can be recirculated for additional dialysis. The progress of dialysis can be continuously monitored by pH meter, UV absorption meters, or samples taken for chemical analysis without interrupting the flow of solution. Two or more dialysis coils can be used in parallel to increase the dialysis capacity.

**Notes:**

1. In general, solutions can be dialyzed by this method in 2 or 3 hours to the same extent as that accomplished by conventional methods in 24 hours.
2. This dialyzer can be used without disassembly, it is light and portable, and its capacity can be expanded easily.
3. Current applications of the continuous counterflow dialyzer are in the purification of proteins and nucleic acids in large scale preparations for research. It is also adaptable for use in pilot plant or full scale industrial processing of blood sera and other biologicals.
4. The basic design is potentially useful in artificial kidney construction.
5. Additional details describing the construction and use of this dialyzer are contained in *Analytical Biochemistry*, 15, 523–529 (1966).
6. Inquiries concerning this innovation may be directed to:

   Technology Utilization Officer
   Headquarters
   National Aeronautics and Space Administration
   Washington, D.C. 20546
   Reference: B67-10395

**Patent status:**

No patent action is contemplated by NASA.

Source: Stanley Mandeles and Ernest C. Woods
of University of California
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