



## Research Test Report

11-02-01

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**Title:** DSU Filters – Long Term Bicarbonate Filtering

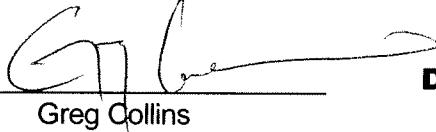
**Report #:** 11-02-01

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**Date:** 2/24/2011

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**Date:** 2/28/2011

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### PURPOSE

Testing was performed to check for any long term effects on the performance of the DSU due to filtering bicarbonate concentrate. The purpose was to verify that the DSU maintained sufficient filtration capacity over the equivalent of one year of bicarbonate concentrate filtering.

### MATERIALS

DSU Filters  
RO Water  
150 L Tank  
Centrisol<sup>®</sup> MB-330 Bicarbonate Powder (45X)  
Stop Watch  
Ceramic Head Pump  
Tubing and Tee Connectors  
Hydraulic Permeability Test Rig

### BACKGROUND

Bicarbonate concentrate especially when mixed from powder may contain some un-dissolved crystals. These could potentially foul the filtration membrane. If a DSU was installed at a single

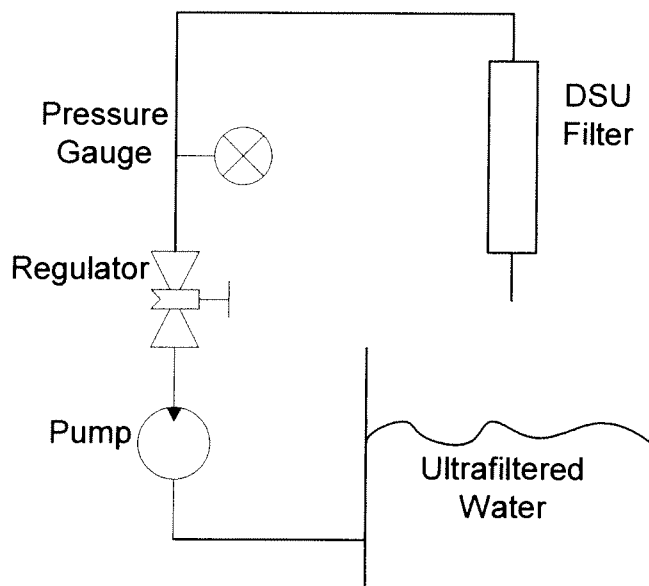
station (i.e. at the wall box), one would expect it to filter approximately 75 L of bicarbonate concentrate per week. This is based on an average of 3.5 patients per station and standard dialysis flow rates and times. If the DSU were installed on the central bicarbonate line feeding a typical clinic of 20 stations it would then filter approximately 75,000 L of bicarbonate over a full year's use.

## METHOD

To test the DSU's for one year use, it was decided that filtering 75 kL was not practical. It was decided to pass 7500 L of bicarbonate through the filters. This is twice the volume the filter would see in a wall box installation scenario. It is 10% of the volume which would be seen in a central line installation. However, it was felt that the 10% is a sufficient volume to demonstrate any trend in the performance of the filter, and that this trend could be extrapolated out to the full volume.

Four DSU filters were selected for testing.

A baseline hydraulic permeability was measured for each filter. A diagram of the test circuit is below.



Ultrafiltered water was recirculated through the DSU so as not to foul the membrane during the testing. Pressure at the inlet was regulated to 15, 30 and 45 psi. At each setting a timed volume collection was done at the filter outlet and the flow rate calculated. The hydraulic permeability was calculated as the slope of the pressure versus flow rate curve.

Once the baseline measurements were completed, the bicarbonate filtering testing was done. The Centrisol<sup>®</sup> powder was mixed in the proper proportion with 150 L of RO water. A circulating pump was kept at the bottom of the tank to ensure that the solution stayed well mixed. The ceramic pump was used to pump solution out of the tank at a rate of 2 L/min. However, the output of the pump was split to feed two DSU's such that each filtered 1 L/min of bicarbonate. When the tank was exhausted the process was repeated for a total of 100 tanks (15,000 liters). After 50 tank volumes and at 100 volumes the hydraulic permeability testing was repeated.

The complete testing was repeated on the other two filters so that a total of four filters each filtered 7500 L of bicarbonate concentrate.

## RESULTS

The hydraulic permeability data at baseline and after 100 tank volumes is presented in the table below. The complete set of raw data resides in the nephros2/expdata/E10 Expts/E10-004 folder. Both the average values and the T-Test P values show that the bicarbonate filtration had no significant effect on the filter permeability.

Hydraulic Permeability (ml/min/psi)

<b>Filter</b>	<b>Baseline</b>	<b>100 Tanks</b>
DU1016	164.4	164.7
DU1017	121.7	142.0
DU1018	159.1	133.3
DU1019	151.1	133.3
<b>Average</b>	<b>149.1</b>	<b>143.4</b>
<b>P-value</b>		<b>0.61</b>

## DISCUSSION

The testing represented a worst case scenario with multiple hand mixed tanks in which the dissolution of the powder may have not been complete. Also the filters were not flushed clear of bicarbonate daily as would occur clinically, but remained filled with bicarbonate over several weeks of testing.

The 3.9% change in hydraulic permeability is likely due to data scatter. However, even if one were to take the extreme view and extrapolate this data for the central line installation. A 39% decrease in hydraulic permeability would still leave the DSU's flow capacity well within the requirements of a central bicarbonate line.

## CONCLUSIONS

It can be concluded that the DSU is fit for use for up to one year as a bicarbonate concentrate ultrafilter without any significant flow degradation.