DE-AIRING OF DIALYSIS FLUID

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The volume of dissolved air in water is mainly dependent on its temperature (Fig. 1).

The water in town-mains is usually pressurised and, hence, the quantity of air in solution may be greater than this so that when dialysis fluid is formed at normal atmospheric pressure a ‘supersaturated’ state is likely to occur. A similar phenomenon occurs when the dialysis fluid is warmed to body temperature. Mechanical agitation of the warmed dialysis fluid aids removal of the excess air, but the process is slow and likely to be incomplete in most dialysis circuits, particularly if water in the town-mains is below 15°C. Air coming out of solution in a Kii! dialyser may cross the membrane and cause ‘frothing’ of the blood in the ‘bubble catcher’, a situation accentuated if a negative pressure is applied to the dialysis fluid. ‘De-bubblers’ fitted to commercially available proportioning machines are not ideal and are also prone to allow contamination of the dialysis fluid with air-borne bacteria.

Fig. 1. Solubility of air in water from 0–40°C. Upper curve at 760 mm Hg, lower curve at 660 mm Hg.

Fig. 2. Diagram of de-airer. Internal diameter of vacuum chamber 1–2 cm.

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The most reliable means of removing air from solution is to introduce a low pressure phase before the dialysis fluid is warmed to body temperature. Several methods were investigated but the simplest consisted of sucking the dialysis fluid through a constriction using a Watson-Marlow EL3N pump, bored out by 0.050 inch (Fig. 2).

Air comes out of solution in the decompression chamber initially as small air bubbles but the turbulence coalesces the bubbles which are discharged by the pump into the header tank. In order to determine the correct size of constricting nozzle for a given flow rate, a test rig was made and the results are recorded in Table I.

<table>
<thead>
<tr>
<th>Inflow water Temp, °C</th>
<th>Bore nozzle mm</th>
<th>Pressure in chamber mm Hg</th>
<th>Flow ml/min.</th>
<th>Air evolved 40°C</th>
<th>Air evolved 50°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>1.0</td>
<td>-600</td>
<td>470</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td>7</td>
<td>1.25</td>
<td>-550</td>
<td>900</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td>7</td>
<td>1.5</td>
<td>-535</td>
<td>1140</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td>6</td>
<td>2.0</td>
<td>-520</td>
<td>1880</td>
<td>Minimal</td>
<td></td>
</tr>
</tbody>
</table>

The decompression chamber can be made from nylon braided P.V.C. tubing, polypropylene or unplasticised P.V.C. pipe.

*Fig. 3. Circuit diagram of static tank system using de-aicher.*

This system has been in use, with no breakdowns, for over a year using a tank supply system sealed with bacterial air filters (Fig. 3). Recently, bacterial water filters have been added to the town-mains supply with a consequent further reduction in bacterial contamination.