Procedures

Electrode Assembly: Pull a 4 mm outside diameter soft glass tube to a 1 mm constriction, break the tube at the constriction and fire-polish all tube ends. After the glass is thoroughly cool, draw up 2–3 cm of salt bridge solution (30 g L^{-1} agar and 0.1 M $CuSO_4$, held at ~100°C in a water bath). Maintain a finger seal at the top of the tube to prevent escape of the solution as it solidifies. After cooling (this will take no more than a few minutes), add 2–3 cm of electrolyte (0.1 M $CuSO_4$) and a 10 cm long piece of 0.5 mm diameter copper wire into the solution. Secure the wire with a piece of tape. Secure a length of combination wire (a 3 cm silver wire electrode soldered to a 10 cm copper wire connection) to the side of the glass tube with a piece of tape. Adjust the height so that the silver/copper junction remains dry for the entire titration. Ensure that the two copper wires are not in contact with each other or the combination electrode will short out and not operate. Store the combination electrode between uses with the salt bridge immersed in distilled water to prevent it from drying out.

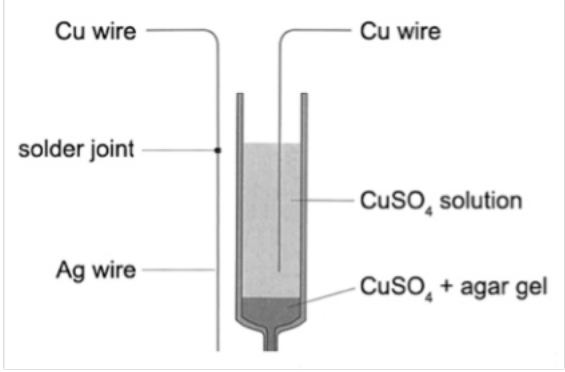

Figure 1. Schematic depiction of the combination electrode used in this method. The $Ag|Ag^+$ indicator appears on the left and the $Cu|Cu^{2+}$ reference electrode with an integral salt bridge is on the right. A cell is completed by immersing this combination electrode in the analyte.