A simplified hot-wire cutting aid for PVC trays used in radioimmunoassay

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The ease and convenience of a hot-wire cutter for the separation of wells from PVC radioimmunoassay trays has been demonstrated.¹ In constructing a similar apparatus, it was felt that a worthwhile simplification could be achieved by arranging to push the PVC tray past a fixed hot wire. The wire can simply be held under spring tension, and the spring-loaded telescopic arm previously employed¹ be eliminated. We feel that this modification may be of interest to laboratories without access to sophisticated workshop facilities.

The general layout of the apparatus is shown in Fig. 1 (a) and (b). The baseboard is laminated from two layers of 12 mm plywood. Basically the apparatus consists of a heated wire stretched between two rails which guide the PVC tray as it is pushed past the wire. Each rail has a shoulder which permits the tray to sit proud of a rubber centrifuge block moulded to hold the wells of the tray. The rails are each machined in two pieces from solid PVC, but could readily be laminated from sheet plastic or plywood. Two PVC strips are screwed between the tops of the rails to prevent the tray from rising during the cutting operation. A laminated PVC block fits between the rails and is used to push the tray and support block past the heated wire by means of a handle of 20 mm diameter PVC rod.

The outer rail is drilled to clear a brass terminal rod mounted through the upper layer of the baseboard. One end of the 26 g Nichrome wire is held in a horizontal hole in this terminal by a set screw. The wire is then threaded through a second brass rod set into the inner rail and is looped and secured to a spring. The spring exerts a force of 1150 g on the cold wire. By angling the spring away from the line of the wire between the terminals, a good electrical contact with the inner terminal is ensured. Screw threads on the terminals allow the height of the cutting wire to be varied.

An isolating transformer with a nominal output of 12 V and 8 A is fitted, as previously suggested.¹ To achieve optimal heating with a 120 mm cutting wire, a further 275 mm is wired in series to provide the appropriate resistance. This is conveniently done between additional brass terminal blocks with porcelain beads and outer glass tubes as insulators. The connections between these “resistors”, the cutting wire and the transformer are made with insulated copper wire between the laminations of the baseboard. The transformer is encased in an aluminium box with an on/off switch and warning light and with a 240 V 1 A fuse in the transformer input circuit and a 12 V 5 A fuse in the output circuit. A prominent warning “DANGER—HOT ELECTRIC WIRE” is permanently attached to the outer edge of the baseboard.

This apparatus can be constructed more easily than that previously described.¹ We found that the optimum length of the heated wire was critical to good cutting performance and was about 395 mm in total. This is rather longer than previously specified although it is not clear which gauge of wire was finally employed.¹ We would certainly recommend that trials be conducted with available transformers and wire before finalising the length of the cutting wire. However, our data suggests that a transformer with an output of 4 V and 8 A would adequately heat a 120 mm, 26 g cutting wire and thus eliminate the need for additional resistors. This conclusion is confirmed by the observation that the voltage drop across the cutting wire in our apparatus is 4 V.

Other trials have shown that the spring tension was fairly critical to the service life of the cutting wire, but with the spring as specified, the apparatus has been used at least 50 times with a single length of cutting wire.

Contrary to previous observations,¹ we have been unable to eliminate smoking during cutting, and would recommend operation in a fume cupboard or other well-ventilated location. Trial experiments with heavier gauge wire (22 g) resulted in poor cutting, with strands of molten PVC smeared between wells so as to partially rejoin them. In view of the critical nature of the spring tension, it was felt that lighter-gauge wire would not be durable enough for the cutting wire.

Before the introduction of the hot-wire cutter, the wells were often cut away from the top of the plate with a hot scalpel blade, resulting in a loss of radioactive counts. Alternatively, the top of the plate was cut up with scissors to separate the wells, leading to increased background radioactivity presumably due to non-specific binding of radioactive material to the top surface of the plate. Thus there was a slight improvement in radioimmunoassay quantification when the hot-wire cutter was used.

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Fig. (a) The cutting apparatus with the PVC well tray and rubber block inserted to the right of the wire, prior to cutting. (b) The PVC well tray and rubber block pushed past the cutting wire by the sliding handle.

References


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