LETTER TO THE EDITOR

A SIMPLE METHOD FOR INSULATING METAL ELECTRODES SUITABLE FOR IMPLANTATION IN THE BRAIN

Sir,

(Received on August 8, 1982)

There have been several well-known materials for insulating metal electrodes, such as 'Insl--X', marketed abroad. The commercially available insulating varnish which is also commonly used for insulating metal electrodes requires several coatings and bakings given over several days to get satisfactory insulation.

Herein, we report a quick method using a low cost insulating material for satisfactory insulating of metal electrodes suitable for intracranial implantations, for electrical recordings or stimulations, and for making lesions.

The insulation material which we propose here consists of a 10% solution (w/v) of polymethylmethacrylate (commonly known as perspex or plexiglass) in chloroform.

The metal electrode wires may be of any of the well known materials like stainless steel, nichrome steel, silver, platinum, etc. The steel wires of selected gauge are straightened by gentle stretching while making them red-hot by passing current through the wires. They are trimmed by cutting to appropriate lengths. If microelectrodes have to be made, the wires are electrolytically etched to reduce the tips to desired sizes. Immersion of the wires in xylene for cleaning should be avoided as it can cause uneven coatings. It is enough if the wires are wiped once with a clean gauze cloth. The cleaned wire is then held in hand and dipped uniformly fast (about 3 cm/sec) into a test tube filled with the above mentioned insulating solution, and withdrawn uniformly and quickly (in about 1 sec) out of the solution. The electrode is held with the tip facing upwards for a few minutes while letting it dry in air at room temperature. The insulation fluid on the electrode dries in about two minutes, leaving a thin layer of insulation on the electrode. Usually, 3--4 such coatings are repeated to make a satisfactorily insulated electrode. If the electrode shank behind the tip is also required to be freed from insulation, the required

area can be made bare by cutting around the electrode tip with a blade and removing the insulation ring. In case of microelectrodes, the tip can be bared by passing a small current for a few seconds through the electrode immersed in saline.

As the insulating solution will be evaporating and getting concentrated due to repeated exposures to air during use, the consistency of the solution can be restituted to the original by diluting with chloroform.

Other synthetic resins mentioned in the Table I, can also be used, but their water absorption and other properties have to be kept in view.

TABLE I : Properties of the resins used for insulations.

	Water absorptopn (24 hr, 1/8" thick-ness, % by mass)*	*Vol. resisti-vity* (Ohms/cm at 5% RH & 23°C)*	*Diele-ctric con-stant**	*Methanol*	*Ethanol*	*Benzene*	*Xylene*	*Chloro-form*
Polystyrene	0.03–0.10	10^{6}	2.45	—	—	++	+	++
Polymethyl-methacrylate (perspex)	0.20–0.40	10^{15}	3.00	—	—	+	+	+++
Polyvinyl acetate (PVA)	0.22–0.25	10^{15}	3.70	+++	+++	++	+	+

+++Very soluble ; ++soluble ; +sparingly soluble; — insoluble.

* Ref ; Modern Plastics Encyclopaedia, Vol. 53, No. 10A, McGraw Hill Publication, p. 456, 457-1977.

The electrodes insulated with perspex or with polysterene can be implanted in the brain after a quick sterilization of the electrodes. The insulation will not be affected if the electrodes are sterilized by immersion for 2–3 min in Savlon (ICI) diluted to 3% with 70% ethanol, and then washing with sterilized distilled water to remove the Savlon–ethanol. The Savlon for sterilization can also be diluted to 1% with distilled water instead of alcohol, and the electrodes should be immersed in it for sterilization for about 30 minutes instead of 3 minutes. It should be noted that the electrodes must not be left for longer periods in the sterilization fluids as longer exposures will erode the insulation. The electrodes should not be heated for sterilization or for drying.

The perspex and polystyrene insulations also stand well in other sterilization procedures like immersion in 40% formalin (1 hr), 5% phenol (1.5 hrs) and Cidex solution which contains formaldehyde and glutaraldehdyde, marketed by Johnson & Johnson (8 hrs). The PVA insulation can stand well only in the Cidex treatment and not in the other sterilization procedures. The electrodes should be washed well with sterilized distilled water after such chemical sterilizations.

In our laboratory, we have been using the perspex or polystyrene insulated electrodes prepared as described above since several months for doing intracranial stimulations, electrolytic lesions, electrical recordings via chronically implanted electrodes, and also for microelectrode work. We have found the above insulation prodcedure to be very simple, quick, cheap and efficient.

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