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Preparation and application of microfilters

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Microfilters have been prepared by etching Makrofol-N irradiated with xenon ions ($^{129}_{54}Xe$). The microfilters thus prepared have been successfully employed to separate *Saccharomyces cerevisiae* (yeast cells) and *Aspergillus nidulans* (fungus spores).

The formation of fine hollow channels along the path of charged particles in the dielectrics by chemical etching has been first described by Price and Walker[1]. The discovery of microfilters has created immense interest among physicists and technologists, because of their controllable pore size, which implies that they can be put to diverse biological[2] and environmental pollution[3] control investigations.

A number of cleavable[3,4] and plastic[4,5] materials available commercially have been studied for formation of micropores. In this note, we report the work carried out using heavy ion irradiated Makrofol-N polycarbonate. A detailed study of pore size variation has been conducted at various temperatures and concentrations of etchant.

Makrofol-N polycarbonate plastic sheets of 5 cm diameter, having thickness 64 μm, were exposed to 7.5 MeV/n $^{129}_{54}Xe$ ions from heavy ion accelerator at GSI Darmstadt, West Germany. The irradiation was made at an incident angle of 90°, keeping the fluences at 10^5 ions/cm^2. These samples were over-etched with 6.25 *N* and 5 *N* NaOH solutions, at 60, 65 and 70°C in a constant etching bath. Duration of etching at various etching parameters was so adjusted that the holes did not overlap. The measurements of hole size were made after one hour intervals. Microfilters of suitable pore size were selected and tested for separation of yeast cells and fungus spores.

Through holes start developing only after an initial latent period of etching, during which etching is taking place and tracks are enlarging once a hole is formed. Increase in its diameter is very rapid, in the beginning, corresponding to the dissolution of the damaged region, after which the increase in diameter follows the bulk etch rate of the undamaged sample. Fig.1 represents the variation of hole diameter with etching time. It is clear from Fig.1 that at low temperature and concentration of etchant, hole size does not vary linearly with time in the beginning of etching. Depending upon the particle size to be filtered, suitable etching parameters can be selected from Fig.1.

The microfilters prepared above were put to the following industrial and biological uses.

Separation of yeast cells—The yeast used in the present investigation for filtration is the *Saccharo-*

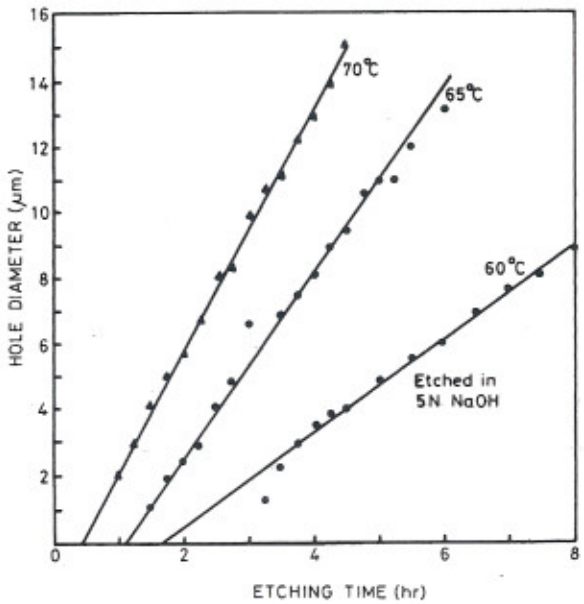

Fig. 1—Variation of hole diameter in Makrofol polycarbonate with etching time in 5 *N* NaOH at different temperatures

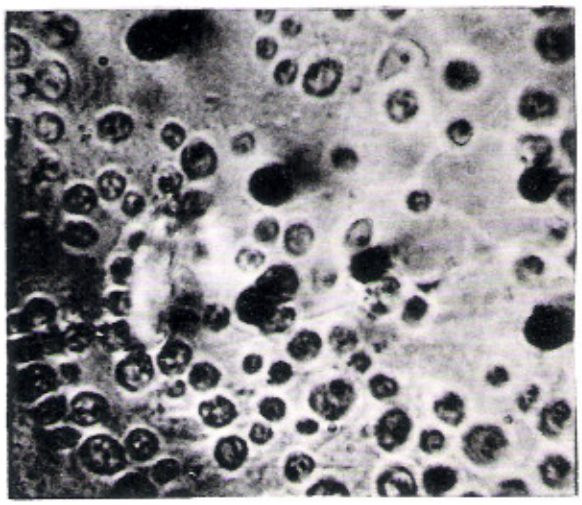

Fig. 2—Microphotograph of *Saccharomyces cerevisiae* separated by microfilter

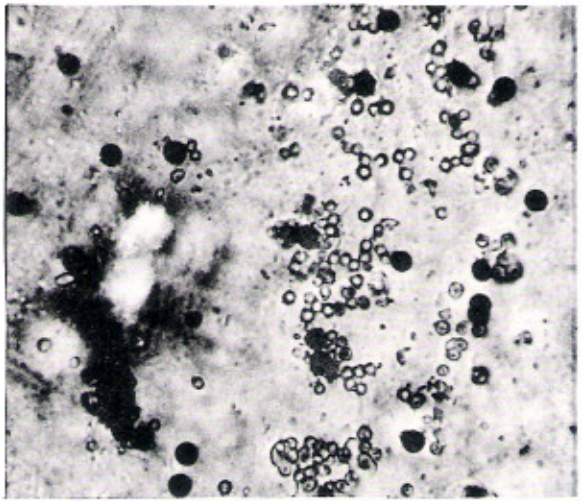

Fig. 3—Microphotograph of *Aspergillus nidulans* separated by microfilter

myces cerevisiae. It is commonly found in wine and beer. To make the beverage suitable for human consumption, yeast cells have to be removed. Filtration is the easiest way to get rid of these unwanted cells. Fig.2 shows *Saccharomyces cerevisiae* (size 5 μm) filtered by a microfilter (size 3 μm).

Filtration of fungus spores—The spore suspension used in the present study to demonstrate the application of microfilters was obtained from *Aspergillus nidulans*. These spores have their application in the field of genetic studies. Microfilters can be employed to collect spores from dilute suspension and sample them according to their size and shape. Fig.3 shows an *Aspergillus nidulans* (size 5 μm) filtered by microfilter (size 3 μm).

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