

Thus it would appear from our results that processes which initiate γ -radiation decomposition have much in common with the processes operating during γ -radiation-induced polymerization of pure monomers.

Varying the extent of decomposition by changing the state in which the sugar is irradiated may find a practical application in the radiation sterilization of sugars, where minimal acid formation is desirable¹³.

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G. O. PHILLIPS
P. BAUGH

Department of Chemistry,
University College, Cardiff.

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CHEMISTRY

Filtration Capacity of Ion Exchange Columns

THE removal of particulate matter from water by mixed bed ion exchange resin columns has recently been the subject of some comment, in particular with regard to the removal of particles of iron^{1,2} and aluminium³ oxides from nuclear reactor loops containing water. We have been concerned with experiments with very dilute solutions, which necessitate the use of water free of suspended matter, and we have observed that this filtration can be extremely efficient. A simple intensity comparison of scattered light from 'AnalaR' water and from water from an 'Elgastat' mixed bed demineralizer, 60 cm long \times 9 cm diameter, showed that at least 50 times more light was scattered from the 'AnalaR' water. The ratio of suspended solids in the two liquids is larger than 50, as there is present a background of scattered light which should be subtracted from the two intensities to obtain a true figure; it is very difficult to distinguish the very small amount of scattered light from the demineralized water from this background illumination.

From some qualitative experiments we have arrived at two conclusions about the mechanism of this filtration, as follows.

(1) The filtration depends, at least in part, on the ion exchange capacity of the bed. This is shown by the simultaneous breakthrough of ions and particles observed when the mixed bed ion exchange demineralizer is exhausted by a continuous flow of tap water. It is also shown by an experiment in which water flow was reversed in a mixed bed containing about 3 g of alumina abrasive particles 3μ in diameter; none of the alumina was removed by this reversal of flow.

(2) The filtration is not a property of mixed beds only, but depends on the resin used, the composition of the particles, and the pH. Thus we have filtered suspensions of washed TiO₂, Cr₂O₃, SnO₂ and SiO₂ in water at pH 5-6 successfully on an anion exchange column in the hydroxyl form; the concentration of the suspension initially was between 0.01 and 0.1 per cent and several gallons of optically clear water were obtained without sign of breakthrough. The diameter of most of the particles in these suspensions was 0.1-5 μ . Electrophoresis experiments showed that all these suspensions were negatively charged; it was consistent with the hypothesis of ion exchange surface adsorption of these negatively charged particles that on addition of the particles to the water flowing into the column, the pH of the effluent rose, indicating liberation of hydroxyl ions from the resin.

When these suspensions were fed to a column of cation exchange resin in the hydrogen form there was immediate partial breakthrough of the solid matter, but there was also partial removal of the particles and a slight decrease in the effluent pH. These phenomena may be explained as due to some non-specific mechanical filtration of the solid and some charge reversal on the particles in the presence of the high surface concentration of hydrogen ions on the resin. In the case of TiO₂ particle removal was negligible at the acidity used, pH 5-6, and an experiment was carried out with a suspension at pH 2, the acidity being adjusted by addition of hydrochloric acid. Under these conditions particle removal was almost complete, indicating that the change in pH had altered the charge on the suspended particles from negative to positive. This would be expected from what is known of the amphoteric character of such oxides and their own behaviour as inorganic cation and anion exchangers^{4,5}. It has been shown that in 0.1 N hydrochloric acid hydrous TiO₂ exhibits anion exchange properties, that is, that the solid phase is positively charged. Our own electrophoresis experiments indicate that TiO₂ at pH 5-6 in pure water is negatively charged; electrophoresis was not possible at pH 2 because of turbulence caused by the high current flowing in the cell.

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C. E. MELLISH
J. A. PAYNE

Wantage Research Laboratory,
U.K. Atomic Energy Authority,
Wantage, Berks.

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Anisotropy of the g-Factor in Aromatic Molecules

AN aromatic molecule may be characterized as one which can carry a ring current. This ring current is induced by an external magnetic field and can be observed by means of its large contributions to the anisotropy of both the diamagnetic susceptibility and the chemical shift. There is another observation which can be used for the same purpose and remains valid for radicals and ions. This is the anisotropy of the electronic g-factor. An unpaired electron, in a molecule or radical, has its spin oriented by the magnetic field which it experiences. This field consists of the external field together with the field at the electron due to induced ring currents of the other electrons. Since aromatic rings are usually planar this second field depends on orientation and results in an anisotropy. The g-factor, in this context, measures the ratio of the effective field to the external field.

The feasibility of observing ring-current effects in electron spin resonance experiments has been investigated