

RADIAL COMPRESSION EXTENDS COLUMN LIFE

The WatersTM Care and Use Manuals contain the recommendation that all silica-based packing materials be exposed only to eluents having a pH within the range of 2 to 8. For longest column life, a narrower range of 3.5 to 6.5 is suggested. However, some separations work best at a mildly alkaline pH, and we must expect that our customers will in some cases expose our column packings to such eluents. Alkaline eluents are generally thought to attack the silica gel matrix, leading eventually to bed collapse (voided columns) in sufficiently extreme cases (1). When alkaline eluents must be used, "sacrificial" precolumns are sometimes employed (2) in an effort to saturate the eluent with dissolved silica. While this approach is reported to prolong column life in the presence of some eluents, additional study is needed to establish the usefulness of such precolumns.

One of the advantages of radial compression is the production of a homogeneous, stable bed structure that eliminates column voiding and channeling. In the presence of an aggressive eluent which may dissolve away small amounts of silica over a period of time, radially compressed columns would be expected to adapt to small losses of packing material. Unlike steel columns, radially compressed columns should maintain their efficiency even under alkaline conditions.

To test this hypothesis, we exposed RESOLVETM silica packing material to an eluent consisting of 40% acetonitrile and 60% of an aqueous solution of ammonium hydroxide (pH 10.7). This harsh eluent was originally used by Atwood, Schmidt and Slavin in a study which promoted the use of sacrificial precolumns (2). Both 15 cm and 30 cm steel columns, as well as Radial-PAKTM cartridges were used. The RCM-100^R Radial Compression Module was chosen to hold and compress the cartridges. No guard column or precolumn of any type was used, as our interest was to see the degree to which column life would be increased by the use of radial compression.

All columns to be tested were exposed to the above eluent at a flow rate of 1 ml/min. At various multiples of 24 hours, the columns were washed with water and a plate count was run. For the steel columns, an extra check at 12 hours was performed. For both 30 cm and 15 cm steel columns, the observed behavior was very similar. After 12 hours, the plate count dropped by 50%, and after another 48 hours the columns contained a 10-15 mm void. For the radially compressed cartridge, 50% of the original plate count value was still obtained at 72 hours, and only after 216 hours of exposure to this eluent was this column removed from the study due to a plate count below 500. Inspection of the cartridge at the end of the study revealed a severely pinched inlet end, showing the degree of compression which was exerted in order to maintain a stable bed structure under these unusually harsh conditions.

The results of this preliminary study indicate a three to fourfold increase in useful column life under conditions which are well outside the pH range that Waters recommends. For mildly alkaline conditions (pH 7-8), it is reasonable to expect a similar effect, although the magnitude of the increase in column life cannot be predicted on the basis of this study. Still, these results should remind us of another unique advantage of radially compressed columns. Additional studies to clarify the value of sacrificial guard columns are underway.

1. Wherli, A., Hildenbrand, J. C. , Keller, H. P., Stanpfli, R. and Frei, R. W. , J. Chromatogr., 149 (1978) 199.
2. Atwood, J. G., Schmidt, G. J. and Slavin, W., J. Chromatogr., 171 (1979) 109.