THE PROPERTIES AND ADVANTAGES OF UNIFORM PARTICLE SIZE ION EXCHANGE RESINS

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ABSTRACT

This paper describes the properties of ion exchange resins that have been manufactured with a uniform particle size distribution. The advantages of these resins over conventional (polydisperse) resins is explained in terms of their kinetic and physical properties and their improved performance demonstrated by comparative tests. Application of these resins in three major areas is described: (i) water softening, (ii) water demineralisation and (iii) ultra pure water production. In each application, the critical resins properties are discussed and the advantages of uniform resins shown with respect to chemical efficiency, kinetic performance, rinse down characteristics, and hydraulic properties.

1. INTRODUCTION

The technology for the manufacture of ion exchange resins has changed little since the 1940's. The production of resins in a stirred reactor results in polydispersed beads with the final resin typically in the -20+50 mesh range. Whilst new resin product development has been limited by this manufacturing process, ion exchange application technology continued to develop with the introduction of mixed beds, layered beds and packed bed systems. In an attempt to overcome the disadvantages of a wide bead size distribution and to meet the increasingly demanding requirements of these application technologies, these resins had to be screened.
2. UNIFORM PARTICLE SIZE RESINS

The development of uniform particle size DOWEX* MONOSPHERE resins (*Trademark of The Dow Chemical Company) in the 1980's, opens the opportunity to tailor resins and optimise their performance to meet the requirements of each specific application. These resins are manufactured directly as uniform beads and are not screened from conventional resins. They have a high degree of bead size uniformity with over 90% of the beads within ± 50 µm of the mean diameter. The resins have typical mean diameters are in the range 300 to 1000 µm. The difference in particle size distribution is illustrated in Fig. 1 for a conventional -20+50 mesh resin and a 500 µm uniform particle sized resin.

![Figure 1. Particle size distribution of conventional and MONOSPHERE resins.](image)

Screening of conventional resins to produce uniform particle size resins is also possible but has a number of disadvantages, not only for the resin manufacturer but also in resin quality. To minimise costs, the coarse and fine fractions have to be blended, compromising the quality of other resin batches. Screened resins also retain the intrinsic characteristic of the original base product. Screening will not improve resin mechanical stability and is likely to cause increased resin damage. The improved mechanical properties are