Novel Synthetic Route to Nonporous Zirconia

- Zirconia particles are stable the entire pH range (1-14)
- Nonporous particles were synthesized using a new synthetic route, with distinct advantages over the Lerot method

New Method

Lerot Method

Collection by centrifugation causes "necks" and particle aggregation

The resulting particles are nonmonodisperse, spherical and nonaggregated.

Reproducibility

Particle Cross-Section

Bonded Materials are Ultra-Stable

Stability testing of vinylbenzene modified carbon clad NPZ crosslinked with polybutadiene coating.

LC Conditions:
Column: 95 x 4.6 mm id; Mobile Phase: 50% A/50% Water; Flow Rate: 1 mL/min; Detection: 254 nm; Temperature: 200°C; 1 µL injection.

Conclusions

- A method was developed for the reproducible production of monodisperse nonporous zirconia particles in the size range of 0.8 to 2.8 microns
- Gentle collection protects size distribution. SEM results show that the particles are spherical and monodisperse
- These particles are stable between pH 1 to 13 and up to 200°C under HPLC conditions
- The synthesized particles are nonporous as demonstrated by SEM of a cross section and by confocal microscopy
- Ultra-fast high temperature separations are possible with little or no toxic waste production
- Nonporous zirconia particles can be carbon clad and surface modified through diazonium salt coupling reactions to create a new class of chemically and thermally stable bonded phase nonporous stationary phases for fast high temperature liquid chromatography
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