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Use of core-shell particles for studying how surface properties affect particle disposition during cross-flow filtration

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Disposition of particles on membranes is one of the most serious problems during microfiltration processes, because it reduces the permeate flux. The flux reduction is most pronounced for suspensions containing colloidal particles. Further, many colloidal particles in organic slurries are water-swollen, which may influence both growth and compaction of the particle layer. This has been studied by filtering core-shell particles, i.e., spherical polystyrene particles with polyacrylic acid covalently bound on the surface. These particles had a hard core and a water-swollen, negatively charged shell; hence the effect of the water-swollen materials could be studied by varying the thickness of the polyacrylic acid shell. The experimental data showed that the *specific resistance* of the disposed material increased with the shell thickness on the particles. The increased resistance was due to polymers what protruded from the surface of the particles and occupied part of the void between the particles. Further, the formed particle layer compressed reversible when the pressure was increased, and the specific resistance increased proportional with pressure. As a consequence, the permeate flux did not increase with transmembrane pressure. The amount of deposed material, and thereby the *total resistance* of the deposed layer, decreased with shell thickness. Thus, a high specific resistance did not result in low permeate flux, because the polymers that filled out the voids between the particles also reduced the interparticular attraction between the particles due to steric hindrance.