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Editorial

Centrifugation and its Application

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DESCRIPTION

Centrifugation is a mechanical process in which centrifugal force is used to separate particles from a solution according to size, shape, density, average viscosity, and rotor speed. The denser components of the mixture migrate away from the centrifuge axis, while the less dense components of the mixture migrate towards the axis. Chemists and biologists can increase the effective gravitational force of the test tube so that the precipitate (granule) moves quickly and completely to the bottom of the tube. The remaining liquid that covers the precipitate is called the supernatant. There is a correlation between the size and density of a particle and the rate at which the particle separates from a heterogeneous mixture when the only force exerted is gravity. The larger the size and density of the particles, the faster they separate from the mix. By applying a higher effective gravity to the mixture, as is the case with a centrifuge, the separation of the particles is accelerated. This is ideal in industrial and laboratory settings, as particles that would naturally separate over a long period of time can separate in a much shorter time. Centrifugation rate is indicated by angular velocity, which is generally expressed as Revolutions per Minute (RPM) or acceleration (g).

The conversion factor between RPM and g depends on the radius of the centrifuge rotor. The sedimentation rate of the particles during centrifugation is a function of their size and shape, the centrifugal acceleration, the volume fraction of the solids present, the difference in density between the particles and the liquid, and the viscosity. The most common application is the separation of highly concentrated slurry solids, which is used in treating sewage sludge for dewatering where less consistent sediment is produced. The centrifugation process has a variety of industrial and laboratory applications; this method is used not only to separate two miscible substances, but also to analyze the hydrodynamic properties of macromolecules. It is one of the most important and widely used research methods in biochemistry, cell and molecular biology. In the chemical and food industries, special centrifuges can process a continuous flow of particle-laden liquid. Centrifugation is also the most common uranium enrichment method based on the small mass difference between the U238 and U235 atoms in uranium hexafluoride gas.

APPLICATIONS

A centrifuge can be used to isolate small amounts of suspended solids from liquids, such as when powdered chalk is separated from water. In biological research, it can be used for mammalian cell purification, subcellular organelle fractionation, membrane vesicle fractionation, macromolecular and macromolecular complex fractionation, etc. Centrifugation is used in various ways in the food industry. In the dairy industry, for example, it is typically used in milk clarification and skimming, cream extraction, casein production and recovery, cheese making, removal of bacterial contamination, etc. This processing technique is also used in beverage, juice, coffee, tea, beer, wine, soy milk, oil and fat processing/recovery, cocoa butter, sugar processing, etc. It is also used to clarify and stabilize wine. It can be used in forensic and research laboratories to separate the components of urine and blood.

It also aids in the separation of proteins using purification techniques such as salting, e.g. Ammonium sulfate precipitation. Centrifugation is also an important technique in waste treatment, as it is one of the most common sludge dewatering methods. This process also plays a role in cyclonic separation, in which particles are separated from an air stream without the use of filters. In a cyclone collector, the air moves in a spiral. Particles with high inertia are separated by centrifugal force, while smaller particles move with the air flow. Centrifuges have also been used to a lesser extent to isolate lighter-than-water compounds, such as oil. In such situations, the aqueous discharge is obtained at the opposite outlet, from which solids with a specific gravity greater than one are the target substances for separation.

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