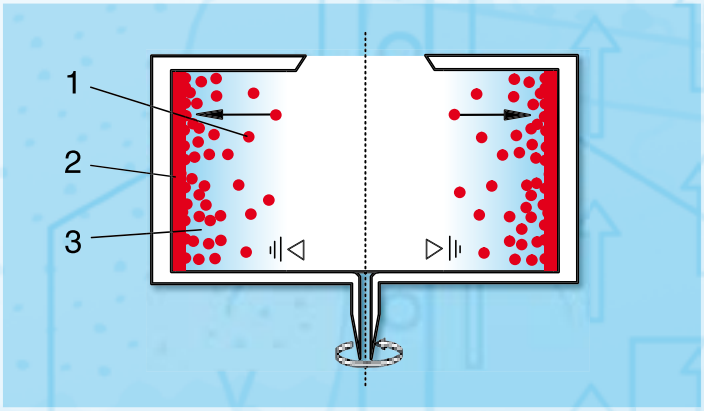
BASIC KNOWLEDGE

SEPARATION IN A CENTRIFUGAL FORCE FIELD



Sedimentation centrifuge:
***1** solid particles, **2** sediment, **3** liquid*

As well as gravity, centrifugal force can also be used as the driving force for phase separation processes. The centrifugal force can be generated either by guiding the flow of the fluid, or by rotating vessels (centrifuges). The difference in density between the fluid and the solid particle results in the separation. The higher-density solid particles are drawn outwards by the centrifugal force more strongly than the fluid particles.

The forces occurring in the centrifugal force field of a **centrifuge** may be many times higher compared to those produced by gravity. Consequently, smaller, specifically lighter particles can be separated in a centrifugal force field than in a gravity field.

Sedimentation and filter centrifuges can be used to separate solid/liquid compounds:

- In *sedimentation centrifuges,* the solid particles collect as sediment on the jacket wall. Sedimentation centrifuges may also have internal fittings such as inclined discs set at an oblique angle to the centrifugal force field (disc centrifuges). This layout reduces the settling distance and time. Disc centrifuges can also be used to separate emulsions such as water and oil.

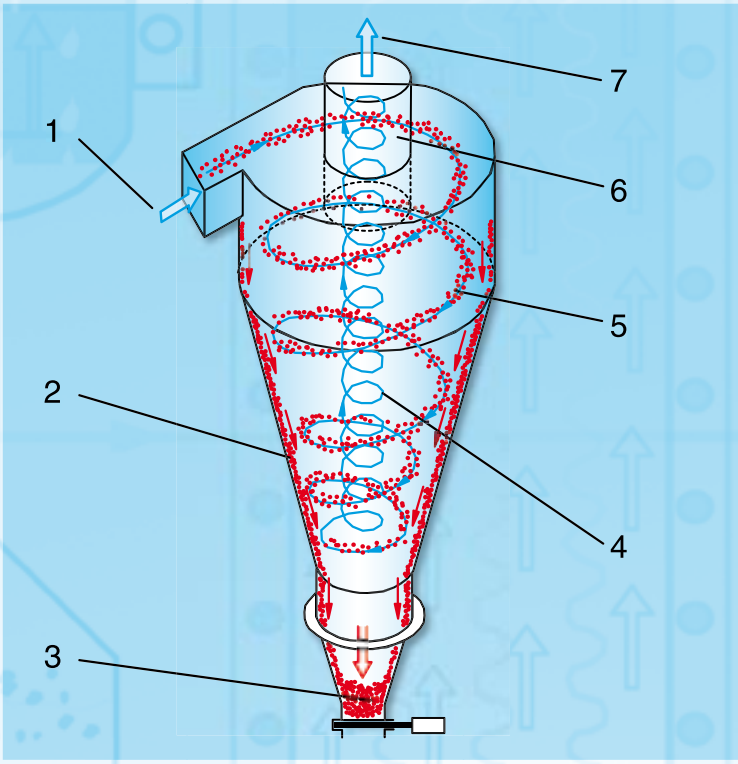
- In *filter centrifuges,* the jacket of the rotating vessel has holes in it. On the inside of the jacket is a filter medium (a fine sieve or filter cloth). The centrifugal forces drive the suspension towards the filter medium, where the solid particles form a filter cake.

In **cyclones**, the centrifugal force needed for separation is achieved by guiding the fluid flow. Cyclones are cylindrical at the top and taper downwards.

The solid-laden fluid enters the cyclone tangentially at the top and is forced into a revolving flow by the cyclone wall. A rotating (primary), downward-moving vortex is created. At the bottom of the cyclone the primary vortex is reversed. As the secondary vortex, the fluid moves upwards in the centre of the cyclone towards the immersion tube, where it exits. The main separation process takes place in the primary vortex. Owing to the centrifugal forces and the difference in density between the fluid and the solid, the solid particles move towards the wall.

In a *gas cyclone,* the solid particles slide downwards and collect at the bottom. Gas cyclones are in widespread use because they can also be used to separate solids from hot gases.

In a *hydrocyclone,* the solid-enriched portion of the liquid close to the wall spirals downwards to the bottom where - in contrast to the gas cyclone - it is continuously discharged. Hydrocyclones are used, for example, in the cleaning of contaminated soils.



*Gas cyclone: **1** raw gas, **2** separated dust,*
***3** collected dust, **4** secondary vortex, **5** primary vortex*
***6** immersion tube, **7** dedusted gas*