

another application about density in mineral process is:

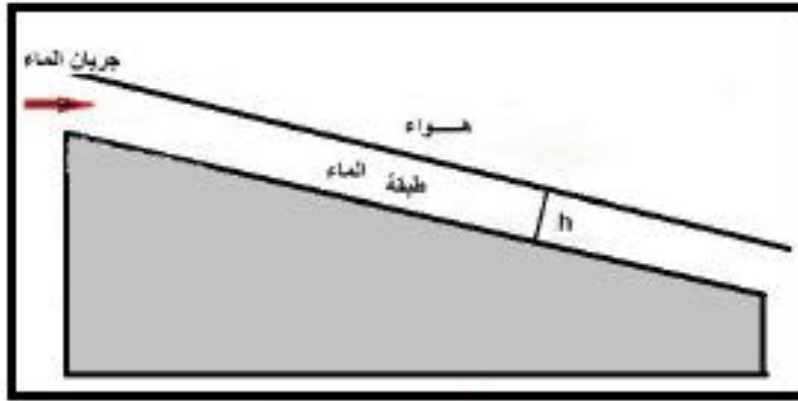
Separation method based on density

It is an important method in mineral separation that depended on density of mineral content, to get success for this technical and for good efficient ,To ensure good separation efficiency, various mineral particles must have a difference in density more than $(1000)\text{kgm/m}^3$.

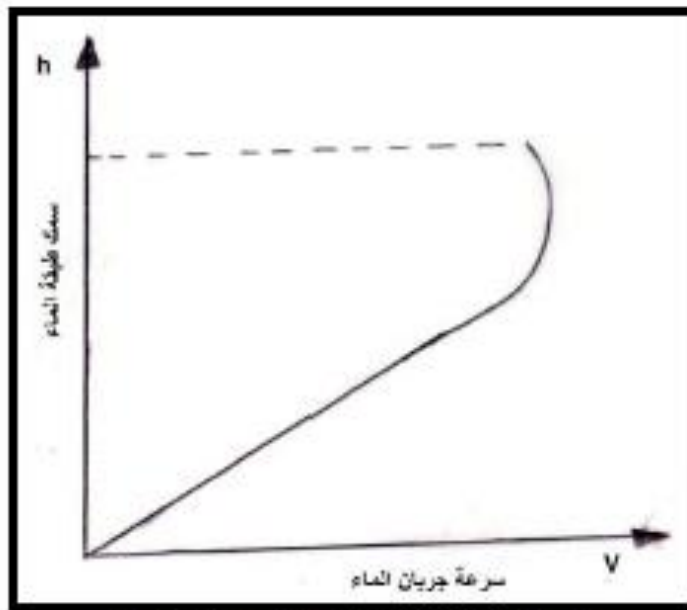
This means that this method depends on the released minerals or that exist freely, such as those found in coastal sand and alluvial sediments.

Some of the oldest techniques utilized in the mineral separation cycle, based on the variance in mass, is the use of the actions of the mineral particles and the essence of their movement in the thin flowing water film as seen in the figure below. That indicates the disparity between the pace of the water and the thickness of the flowing water.

The water adjacent to the surface of the inclined metal base used in the separation process is almost constant, and the speed of the water increases when moving away from the metal base and then the speed decreases at the point of contact with the water surface of the air layer, as noted in the following figure

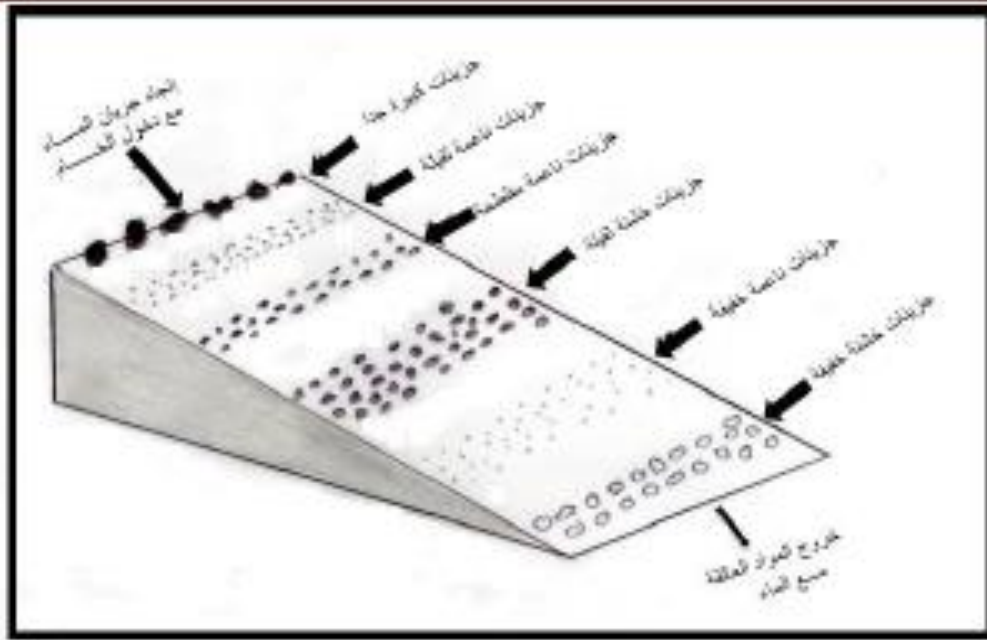


مستحلبة جريان طبقة خفيفة من الماء

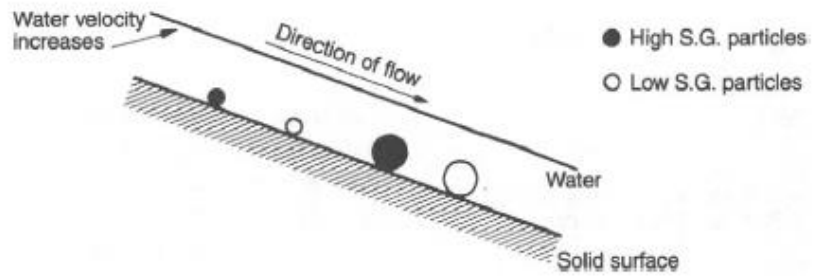


سرعة الجريان وعلاقتها مع سمك طبقة الماء

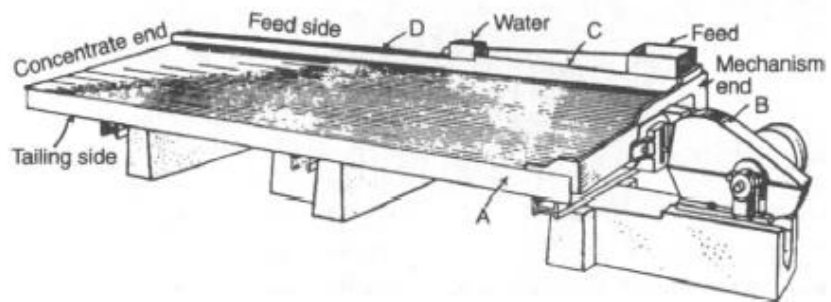
شكل يوضح ترتيب تقنية الفصل المعدني باستخدام طبقة رقيقة من الماء الجاري على سطح معدني مائل بدرجة معينة قد يكون ثابت أو متحرك.



{ مقطع يوضح تسلسل فصل الجزيئات في طبقة خفيفة من الماء على سطح مائل



Action in a flowing film



Shaking table

Mineral particles with an approximate diameter of the thickness of the water layer or with the same density tend to collect on the inclined surface in a particular area, depending on the relationship between the degree of surface tilt and the velocity of flow of the aqueous layer with the distance, density and shape of the mineral particles.

It gives a strong insulation effect by using this process, which means that when particles of various sizes and shapes are put, the particles of large sizes are deposited faster, while the small particles are floating along the water stream, precipitating elsewhere on the inclined surface, depending on the degree of inclination and the speed of the water.

However, if the volumes are equal and the densities are different, the high density particles will settle faster than the low density particles.

An important application of this method is a shaking table, which is a rectangular table that is inclined to a certain degree and can be moved with an asymmetric straight horizontal frequency and is also returned vertically in the direction of the water flow, The mineral particles would therefore have force in many directions and the effect of this force is the course and position of the stability of the granules. The swinging motion of the vibrating table causes the metal particles of similar characteristics to travel intermittently towards one end of the table and to group together as bundles in one position.

Continuous feeding while maintaining the same conditions described above leads to the possibility of a material separation of the required particles.

The shaking table usually made of wood coated with a high coefficient of friction, such as plastic or rubber with an oblique angle between $(6-0)^{\circ}$, and put tapes in lower high or spiral cavities perpendicular on water flowing direction to increase separation coefficient, because it is make to cumulated particle in uniform place, strips are placed on the table surface at a slight height, or spiral cavities are made vertical to the direction of the water flow to improve the separation efficiency by allowing the particles to be grouped in uniform locations.

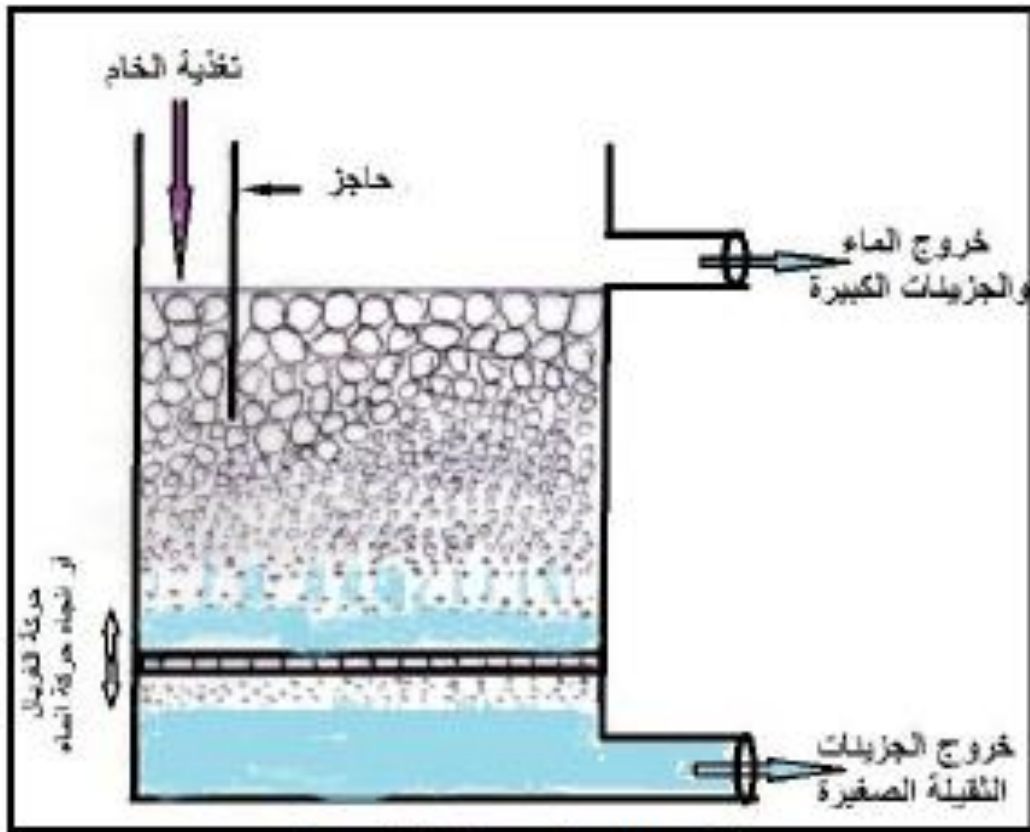
This technical used while separate particles size between (25-250) micron, When the table area is (3x1) m² the separated particles capacity is (5) tons/hour, from raw materials.

An alternative method for shaking table is jigging , it is old method to separate depended on specific weight it is separate large particles size between (40)mm to (2)mm, this method separate particles size larger than this in shaking table method, the technical worked by put particle or ore in iron cylinder have screen in bottom. the screen has a suitable and calculated apertures size with the particle required size separate from the ore.

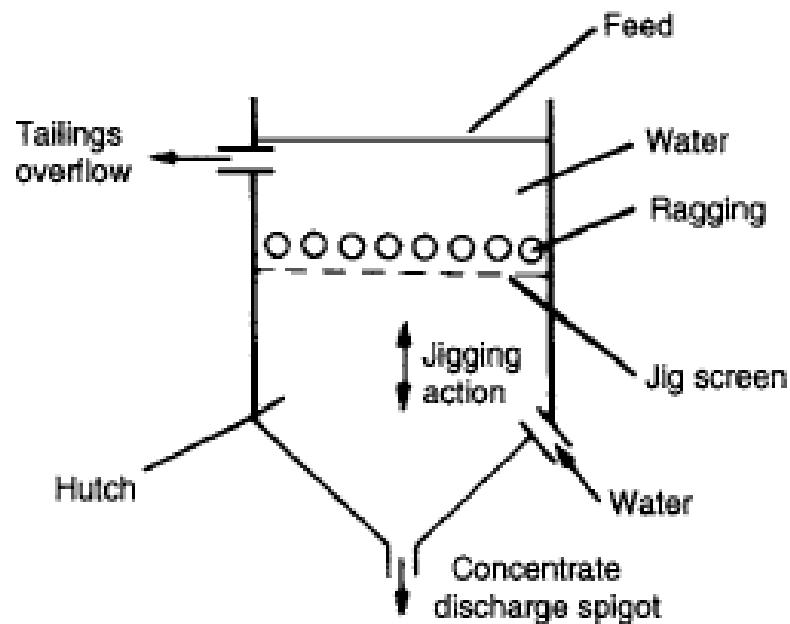
The cylinder fills in the water from the bottom of the sieve and exits from the top of the cylinder, and the separation is carried out by constantly moving the sieve with the materials going up and down regularly. In this method, similar granules tend to form layers, whereas small and heavy particles tend to cluster at the bottom of the cylinder, while light, large particles tend to be concentrated upward.

Continuous processing and feeding leads to the continuous accumulation of particles in the form of layers and the separation of the light particles.

This method is widely used in the separation and extraction of charcoal because charcoal is less dense than the associated minerals and accumulates in the upper layers, where gold, cassitrite (SnO₂) and diamonds are collected in the lower layers, and the granular size is approved for use in this method between (-10μm to +200μm).



مخطط جهاز فصل الجزئيات نوع jig



Basic jig construction

3-Dense – medium separation

It is easy to separate sand particles from sawdust, for example, when the mixture is put in a water tank. For the same way, two minerals can be separate into any metal mixture. Once this mixture is put in a medium-density liquid, a low-density mineral floats and The medium used in the laboratory for metallic partial separations is a thick inorganic liquid, but this liquid is costly in addition to being poisonous and thus can not be used commercially in mineral extraction plants.

The aqueous medium suitable for mineral separation can be prepared by placing fine, slow-moving solid particles in water which remain suspended in water. It acts as a medium density suitable for the processing mineral separation and is called the "heavy media".

The properties of heavy media that use in this process are:

- Resistant to chemical and physical disintegration.**
- Maintains its density during separation processes.**
- Easy to recover and reuse after separation operation.**
- Available and cheap for commercial use on a large scale.**

The most liquid used in mineral separation are:

1-Organic liquid :the density of this liquid is between (1.4 – 3) gm/cm³, it is limited used in commercial separation but mostly used in laboratory purpose , it give better separation of compared to other Suspensions because of low viscosity.

2-Solid plankton: its mostly used in industrial filed , usually used magnetite Fe₃O₄ dense (5.1)gm/cm³ when mix with water density will be (2.8)gm/cm³, as well as use ferrosilicon materials FeSi in dense (6.8)gm/cm³ when it mix with water it density will be (3.6)gm/cm³.

Preferably use ferrosilicon because it form from spherical particles it is deal to reduce the apparent viscosity and also can geting higher dense from magnetite, we get dense (3) gm / cm³ if mix the two

material together. To get aconstant density it is must to continue moving the liquid to prevent deposition of particles and reduce density of liquid.

Another application for Dense – medium separation are coal separate , iron ore, zinc, and lead.