Gravity Separation of Talc

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Abstract

Talc is an industrial mineral that has a theoretical formula of $Mg_3Si_4O_{10}(OH)_2$; it has been used in many industries such as paper making, paint, plastic, food, pharmaceuticals, cosmetics, ceramics, etc.[1] The characteristics of the talc mineral in this project was investigated using X-ray diffraction and it was found to contain a fair amount of magnesite and iron oxide as major gangue. Experiments were conducted based on the interest of how well gravity separation (Spiral concentrator and Knelson concentrator) methods could enhance the whiteness of this specific talc mineral.

Theory & Equipment

Gravity Separation

Gravity separation is a type physical separation method that relies on the density difference of valuable mineral and gangue.

Spiral Concentrator

Wet spiral separation is the technique used in this project. It is based upon a combination of the solid particle density as well as the particle's hydrodynamic properties.[2]

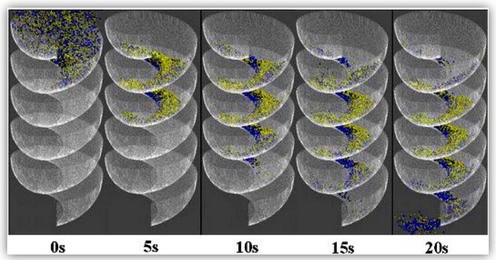


Figure 1: Simple illustration of how light (yellow) and heavy (blue) particles separate in a spiral. [3]

Particles in spirals follow two simple rules of separation:

- Light and large particles are pushed into the outer radius region and flow down.
- Heavy and fine particles remain in the inner radius region and glow down.

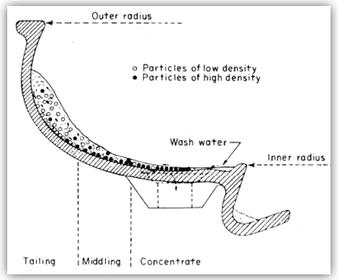


Figure 2: Light particles in suspension travel outwards; heavy particles settle on the trough slide inwards. [4]

Knelson Concentrator

Knelson concentrator separate particles by gravitational force which is strengthened by centrifugal movement.

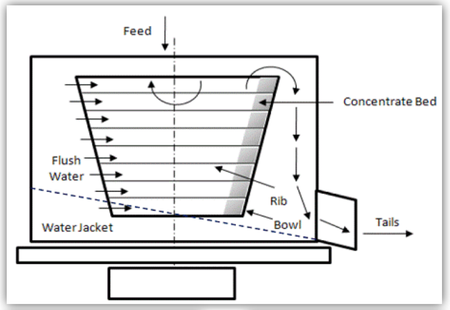


Figure 3: A cross-sectional illustration of a Knelson concentrate bowl. Concentrates tend to stay at concentrate bed because of centrifugal force whilst light particles tend to overflow. [5]

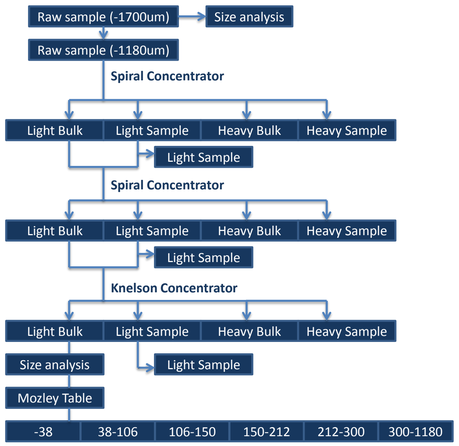
Figure 4: An empty Knelson concentrate bowl (left); A Knelson concentrate bowl with heavy materials (right).

Mozley Laboratory Separator

The Mozley table is a flowing film device designed to treat small amount of sample and analyze its recovery. [2]

Figure 5: A Lab-use Mozley table with V-shape tray.

Experiment Design



- Talc, as the valuable mineral, has specific gravity of approximately 2.5 while one of the major gangue, iron oxide, has specific gravity of about 5.2.
- The objective is to concentrate the light particles (Talc).

Figure 6: Designed project experiment flow sheet.

Results

Talc and Iron Oxide Grade

The objective of this project is to improve talc grade whilst reduce gangue material's mainly by spiral concentrators.

Whiteness

Whiteness is one of the most important criteria to decide the grade of talc; it is evaluated by the brightness and yellow index.

	After 1st spiral test	After 2nd spiral test
Talc%	35%	45%
Fe_2O_3%	10%	8%
Brightness	42	50

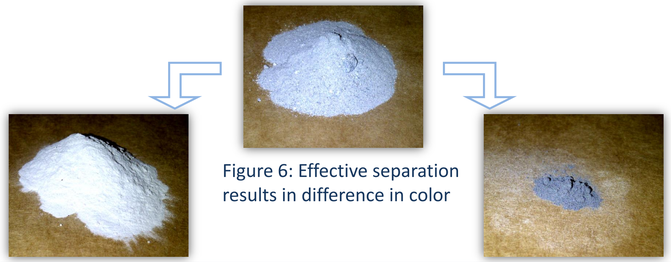


Figure 6: Effective separation results in difference in color

Conclusion & Future Work

- Gravity separation is proven to be an useful experimental method to improve the whiteness of Talc magnesite containing magnetite.
- Future work is mainly about optimizing the best condition for gravity separation of Talc.

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