

CLAYS CONTAINED IN MINERAL ORES AND THEIR EFFECTS ON SOLID-LIQUID SEPARATION PROCESSES

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ABSTRACT

Dry stacking of filtered tailings usually requires a low cake residual moisture to meet the specifications from geotechnical engineers. The growing demand for minerals has resulted in lower and more complex grades of ores being mined and processed. Many such ores contain varying amounts of clays. The filtration process can be hindered by the presence of clays and it's important to understand the filtration characteristics of these ores at a very early stage in the flowsheet design.

Other solid-liquid separation processes can be affected by the presence of clays, including thickening. Thickening, even in the beneficiation stage, can be severely compromised, leading to lower process efficiencies downstream (e.g. leaching). Poor thickening performance caused by non-ideal mineralogy (particularly clay content) can force the process designer to consider filtration as a more appropriate solid-liquid separation option (in some cases, even replacing counter-current decanting thickeners).

Some clays affect solid-liquid separation processes more than others. A comprehensive characterization of the ore that includes detection and identification of clay types is important. Standard physical-chemical characterization of mineral slurries includes tests for density, solid concentration and solid (and liquid) specific gravity. More thorough characterization can include tests for yield stress, particle size distribution and morphology, as well as element analysis and mineral phase detection. Some of these tests require sophisticated instruments and highly-experienced technicians.

Phyllosilicates (clays) are one of the most common components of mineral ores and tailings, together with quartz, feldspar and other aluminosilicates. Their content is not necessarily predominant but their presence, even in small concentrations, can influence slurry behavior and filter cake permeability and moisture content. A comprehensive study of clay detection and quantification, including correlation with dewatering properties was recently carried out by Diemme Filtration's R&D laboratory. Some of the results and conclusions of that study are presented here. The paper also uses real project examples to illustrate how the presence of clays in mineral ores can change the flow sheet design and influence the sizing of filtration equipment.

Keywords: solid-liquid separation; thickening; filtration; dry stacking, mine tailings, filter presses, clays; beneficiation; leaching