Fines-Dominated Tailings Dewatering

Background

Fine dominated tailings, defined as over 50 wt% of <44 µm size fraction in tailings, are challenging to manage. Fine tailings usually contain significant amount of clays, which make them difficult to dewater and consolidate due to low permeability. Over four decades, chemical aids (e.g. flocculants/coagulants) have been used to improve fine tailings dewatering with or without mechanical (e.g. centrifuge, etc.) enhancement [1]. Many technologies have been tried without much success in commercial operations due to techno-economic feasibility issues. For example, some operations manage to produce a centrifuge cake with 55 wt% solids from the flocculated mature fine tailings, but it is still not ready for reclamation.

Extensive research has been conducted to understand the fundamentals of fines tailings dewatering and consolidations, including the following topics:

- Characterization of fluid fine tailings and their interaction with bitumen/organics ([1],[2]);
- Evaluation of the effects of different flocculants, coagulants, modifiers of surface hydrophobicity/ rheological properties on settling and centrifugation and filtration in laboratory, pilot testing and commercial operations [3];
- Impact of bitumen in tailings settling and consolidation [4];
- Effect of mixing and shearing on fluid fine tailings flocculation and transportation [5]; and
- Chemical assisted mechanical dewatering using centrifuge or filter press [6].

These studies have improved our understanding of both fundamental mechanism and operation performance. No breakthrough has yet been made that achieves dewatered the fines tailings with over 60 wt% solids economically.

Statement of Research Opportunity

The new solution is expected to treat the fluid fine tailings produced from the conventional minable bitumen extraction process to obtain fines tailings with >60 wt% (+/-5 wt%) solids consistently through a microbiological, chemical, or mechanical process, or their combination.

Desired Results

Better understanding of surface modification mechanisms of fines tailings particles must ultimately result in practical ways of dewatering fine dominated tailings to reach over 60 wt% solids. This should allow the fine tailings to be disposed along with coarse tailings to a dedicated deposition area economically and would reduce or eliminate the needs for fine tailings impoundments.

Works Cited

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