

Sloping Sand Filtration Bed for Mineral Sand Plant Effluent Clarification¹

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Abstract: The Southern Ionics Minerals, LLC (SIM) mine and mill in southeast Georgia recover heavy mineral sands rich in zircon and titanium minerals. The sand ore contains a naturally-occurring, low-density organic humate fraction that is dissolved and suspended in the process water. Process water can be treated to settle humates, but settled humates are notoriously difficult to de-water and cause long-term pond management challenges. Thus, a low-cost efficient process was needed to remove and dewater humate particles from a process stream with a typical flow rate of about 380 m³-d⁻¹ and a concentration of 400 ppm TSS.

Flocculating and coagulating reagents facilitated settling but the process solution still required clarification. Slow sand bed filtration and other solid-liquid separation methods (e.g., settling ponds, nanofiltration, and commercial sand filters) were considered and rejected due to excessive costs and maintenance concerns associated with repeated back-flushing and handling settled humates. A 50-year-old “passive” de-watering technology looked promising: the metal mining industry used sub-aerial deposition methods similar to slow sand bed filtration to manage very fine-grained tailings (minus 74 µm). The process is described in more detail in the on-line [GARD Guide](#).

Following the design principles for sub-aerial tailings management, the design team devised a series of bench tests that SIM personnel conducted at the mill site. The team called the process the “sloping sand bed” (SSB). Positive results from a series of batch and continuous flow tests supported SIM’s decision to construct a full scale 0.57 ha SSB to handle an average discharge of 0.26 m³-min⁻¹ containing just 0.05% suspended humate. A full scale SSB was constructed over the spring of 2017; it began to receive humate laden feed from the mill in October 2017. It is functioning as designed and its discharge meets SIM’s water quality goals.

Additional Key Words: sub-aerial tailings deposition methods

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 3. Work reported here was conducted near 31°25'1.52"N; 82° 6'5.79"W.