Treatment of mining slurries by flocculation of suspended solids and heavy metals

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Most forms of mining use large quantity of water and the wastewater contains a high degree of suspended solids. Slurry or slime are terms commonly used to describe the highly turbid and muddy suspension of very fine clay particles, silt and soluble mineral components which may contain an appreciable amount of toxic heavy metals. Conventional mining practice requires the wastewater to be stored and treated at the mine site. The slurries are often left to settle in large ponds where the fine suspension settles leaving a water layer at the top. This clear water is reused, thus minimising the use of water in the mining operation. However clay particles in suspension settle very slowly on its own and the process of dewatering can take months or years. Since mining is continuously discharging slurries, the holding ponds for the slurries would require large areas to be set aside for this purpose. Malaysia's long history of alluvial tin mining, has left a legacy of numerous ex-mining ponds and ex-mining land with buried slime. Houses and other structures built over such land have often encountered serious settlement problems.

Over the past thirty years, various means have been adopted to speed up the process of settlement of the very fine clay in the slurries, with varying degrees of success. A number of chemical reagents has been found to be effective in hastening the dewatering process, usually by a process of flocculation of the clay particles. However the effectiveness of the reagents depend on a large number of factors such as the composition of the suspended solids, the pH, the chemistry of the wastewater, the percentage of the solids in the slurry and the method of introducing the reagents. Different types of mining generate different types of slurries and the effective dewatering process is often different for each mine. A considerable amount of research is required before a workable dewatering process is found. Environmental requirements in many mining areas compel the mining companies to find solution to the problems posed by the slurries and most mines have been successful in finding solutions to the problems caused by the suspended solids. Research carried out on mining slurries in Peninsular Malaysia has identified the reagents which are very effective in dewatering the slurries. Of these reagents, natural rubber latex has been found to be most effective as a flocculation agent. The flocculant works by binding the clay particles and metallic ions into large flocs which settle instantaneously. The resulting flocs are very stable, an important factor in tropical environment where high rainfall and the resulting runoff may transport the flocculated material into the natural drainage system.

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