

RockTron Beneficiation Process

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Essentially, RockTron uses a traditional mining technology, called 'froth flotation'. This beneficiation process separates and washes the components that make up fly ash to produce new eco-minerals which have many applications. The overall objective was to process power station PFA waste from tip, lagoon and fresh arisings to produce economically viable products with no waste or effluent. Historically, BS 3892(1) and BS EN 450(2) – the British and European Standards stipulating the use of fly ash as a cement substitute – emphasise the key measures of particle size and carbon content. While dry classification and/or selective removal has been successfully employed for the past 20 years, power stations producing fly ash with a high carbon content had no alternative but to stockpile their waste. So RockTron set out to remove the carbon content in order to produce an economically viable cementitious alternative with typically <2% Loss on Ignition (LoI).

Stage 1: feed

RockTron's plant can accept feed from either stockpiled, lagoon or fresh ash from a power station's precipitators. Fresh ash from electrostatic precipitators is sluiced with recycled process water into a pump suction tank where the pulp density is automatically controlled for optimum pumping to the plant (typically 30% solids). Star valves in the fly ash silo automatically control the solids rate. The slurry is then pumped into a specially designed receiving vessel, the cenospheres removal tank. The vessel's design allows gentle agitation and physical separation of the cenospheres under gravity. The resulting CenTron product has particular applications in the automotive and aerospace industries. Fly ash recovered from the tip or lagoon (1km away) is repulped to its original particle size. Any extraneous material found in the waste (eg, vegetation matter) is removed so the material can conform to a similar size distribution to fresh ash and join the main stream for cenosphere removal.

Stage 2: flotation circuit

The remaining slurry is then pumped into the flotation circuit, the central hub of the plant where pulp density is established and mixed with reagents to ensure product quality. The whole circuit is fully automated and insensitive to widely fluctuating changes in head grade. The culmination of these processes causes the carbon to float off. A cleaner circuit cleans it to increase the overall grade with a target of >90%. The carbon is then dewatered on a horizontal belt filter and, if required, flash dried. In filter cake form the coke (coal without volatiles) is ideal for mechanical handling and reuse by the power station ensuring full coke utilisation.

Stage 3: magnetite removal

Following carbon removal, the remaining product is alumino-silicates. This slurry is eventually separated into the RockTron Alpha and Delta products for the cementitious market. However, these alumino-silicates also contain spherical magnetic particles in the form of $\text{Fe}_3\text{O}_4\text{-Al}_2\text{O}_3\text{-SiO}_2$, a form of magnetic rich glass spheres. Removal of the magnetite is discretionary. It can be left in or recovered by powerful magnets to create a new supply of spherical magnetite for applications such as RF shielding and conductive polymers.

Stage 4: classification

The remaining alumino-silicates are then pumped into high efficiency hydrocyclones (used in the clay industry),

classified into two particle size groups resulting in the fine 7 μ m (d50) Alpha particles and the coarser 45 μ m (d50) Delta particles. Delta is then dewatered to 15% moisture and stored in bulk. Alpha is dewatered to <0.5% moisture and stored in silos.

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