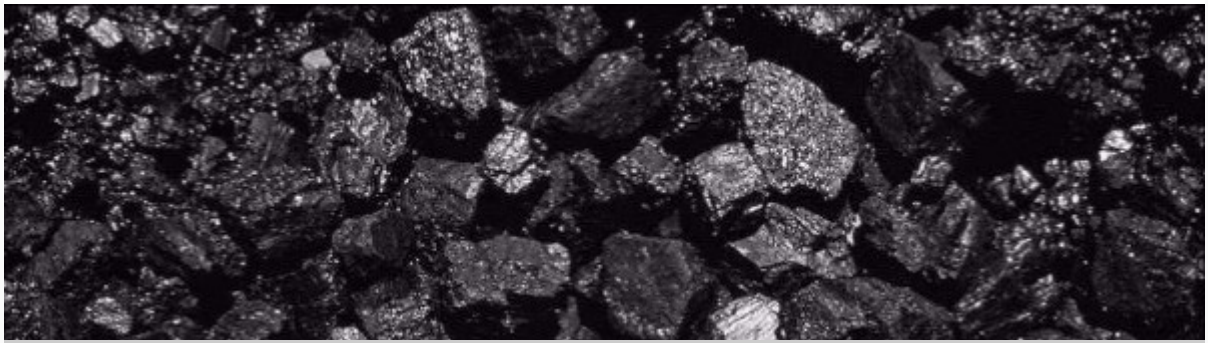
ACARP Matters



Fine Coal Agglomeration Delivers Ultrafast Processing at High Recovery

Researchers at the University of Newcastle have developed an effective and robust system for fine coal agglomeration and recovery which is achieving impressive results at pilot scale.

Enhancing work already undertaken on the novel emulsion binder – which comprises 95% aqueous salt solution, 2.5% kerosene and 2.5% sorbitan monooleate (the emulsifier) – this ACARP project aimed to develop a continuous version of the agglomeration process based around a simple flow constriction. Due to the speed with which the emulsion binder achieves agglomeration, the continuous process only requires a high shear zone created by a simple

flow constriction to form the agglomerates.

Flow constriction is achieved via an orifice plate – an inexpensive, wear-resistant disc with a given hole size. Constricting flow increases the slurry flow velocity, thereby increasing pressure and producing a higher shear rate. A high shear rate results in different parts of the slurry flow travelling at different velocities, which promotes collisions between the coal particles and binder. The strong forces also cause the binder to form fragments, leading to new surfaces for the agglomeration. The fragments readily coalesce due to the water permeation into the binder. Air is introduced to the process to improve the buoyancy of the agglomerates.

Although the agglomeration is very fast, it is still necessary to separate the agglomerates from the tailings. Researchers combined a downcomer/sparger arrangement used for flotation with a simple trough-style tank to separate the buoyant agglomerates from the majority of the suspending water and finely dispersed mineral matter. Not only does this system remove the majority of the water and mineral matter associated with the product, it produces a relatively clean product.

Kevin Galvin said at a feed flow rate of 40 L/min in a 25 mm diameter pipe, researchers achieved a combustible recovery of 75% at 7.4% product ash using high-ash, ultra-fine coal tailings as the feed.

“In subsequent experiments, however, there was some scatter in the performance, especially in the reject ash but product ash values remained acceptable as long as the overflow rate was minimised. We propose that if the size, and thus buoyancy, of all of the agglomerates is increased in the slurry prior to the trough separation, the results achieved here may be improved considerably. Overall, flow rates as high as 128 L/min can be used in the 25 mm diameter pipe, while the trough system can be run at flow rates of up to 100 L/min,” he said.

“This research confirms that fine coal agglomeration is an economically viable beneficiation method; the amount of oil required is at least a tenth of what was previously required. The oil addition is much higher than required for flotation, but substantially lower than for traditional oil agglomeration. Recent data indicates the agglomeration achieves lower product moistures than observed by conventional flotation.

“Because the process is so fast, a stirred mixing vessel commonly used in traditional oil agglomeration is not needed, making the system lighter with a much smaller footprint. The process also proved to be highly selective, reducing high ash tailings to about 10% ash.”

Kevin said this fine coal agglomeration process always generated a lot of interest during demonstrations because it was so fast and complete.

The next step for researchers is to scale up the pilot system to treat ultrafine tailings on site, and Kevin is in discussions with industry participants regarding a potential site.

“The industry is looking to recover coal from tailings. If this can be achieved, a product could be created while almost halving the volume of tailings,” he said.

ACARP Industry Monitor and MACH Energy Australia Senior Process Engineer Thomas Wilson said 3D flotation of fine coal had proven to be an effective way of recovering coal from tailings at laboratory and pilot scale.

“One of the largest sources of coal loss in coal handling preparation plants is fine coal to tailings streams. If 3D flotation can be proven to work at full scale on site, it has the potential to have multiple benefits as it will create a saleable product while reducing volumes of tailings produced,” he said.

For further information:

The final report is available from the ACARP website. Report number C25008

www.acarp.com.au

E: nicole@acarp.com.au

P: 07 3225 3600