

ABSTRACT

The existing screw conveyor mechanism in the Jetspray machine at an extreme inclination of 40° experiences axial transportation failure in conveying Resin Coated Sand (RCS). The cohesive properties of the RCS material, combined with an open flared trough casing and a full pitch configuration, trigger a massive material fallback phenomenon. This research aims to evaluate the existing design and analyze the modification of rotational speed and geometry to optimize the mass flow rate. The numerical Discrete Element Method (DEM) was conducted using Altair EDEM software. Simulation results show that the existing design at 25 RPM only achieves a transfer efficiency of 68.23% with an average mass flow rate of 0.116 kg/s. Increasing the rotational speed to 50 RPM on the existing geometry is considered ineffective, as the mass flow rate only increases to 0.131 kg/s due to the substantial amount of material fallback. Significant optimization was successfully achieved through a combination of 50 RPM rotational speed, a half pitch configuration, and an NPS 1" shaft, which boosts the flow rate to 0.295 kg/s. The absolute peak performance is demonstrated by the closed casing (tubular trough) design at a rotational speed of 50 RPM; despite having a smaller screw diameter of 4 inches and an NPS 3/4" shaft, it is capable of recording an efficiency of 94.63% and a flow rate of 0.370 kg/s. As a technical recommendation, the existing machine can be sufficiently modified using half pitch components at 50 RPM. For future fabrication, the tubular trough design is highly recommended by adopting an intermittent operating system and increasing the gearmotor power capacity to accommodate the surge in operational torque.

Keywords: Screw Conveyor, Resin Coated Sand, Material Fallback, Discrete Element Method, Optimization.

INTISARI

Mekanisme *screw conveyor* pada mesin *Jetspray* eksisting pada kemiringan ekstrim 40° mengalami kegagalan transportasi aksial dalam memindahkan pasir *Resin Coated Sand (RCS)*. Sifat material RCS yang kohesif, dipadukan dengan selubung terbuka tipe *flared trough* dan konfigurasi *full pitch*, memicu fenomena kemerosotan material (*material fallback*) secara masif. Penelitian ini bertujuan mengevaluasi desain eksisting serta menganalisis modifikasi kecepatan dan geometri untuk mengoptimalkan laju aliran massa. Metode numerik *Discrete Element Method (DEM)* dilakukan menggunakan perangkat lunak ANSYS. Hasil simulasi menunjukkan desain eksisting dengan 25 RPM hanya mencapai efisiensi transfer 68,23% dengan rata-rata laju aliran massa 0,116 kg/s. Peningkatan kecepatan menjadi 50 RPM pada geometri eksisting dinilai kurang efektif hanya naik menjadi 0,131 kg/s akibat besarnya material yang merosot. Optimalisasi signifikan berhasil dicapai melalui kombinasi putaran 50 RPM, dengan konfigurasi *half pitch*, dan poros NPS 1", yang mendongkrak laju aliran menjadi 0,295 kg/s. Performa puncak secara absolut ditunjukkan oleh rancangan selubung tertutup (*tubular trough*) dengan kecepatan rotasi 50 RPM, walaupun dengan diameter *screw* dan poros lebih kecil yakni 4 inch dan poros NPS 3/4", namun mampu mencatatkan efisiensi 94,63% dan laju aliran 0,370 kg/s. Sebagai rekomendasi teknis, mesin eksisting cukup dimodifikasi menggunakan komponen *half pitch* 50 RPM. Untuk fabrikasi masa depan, desain *tubular trough* sangat direkomendasikan dengan mengadopsi sistem operasi periodik dan peningkatan daya *gearmotor* untuk mengakomodasi lonjakan torsi operasional.

Kata Kunci: Konveyor Sekrup, *Resin Coated Sand*, *Material Fallback*, *Discrete Element Method*, Optimasi.