

Large scale ecological utilization technology of coal gangue for waste treatment

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Novelty and practicality

This project presents a large-scale ecological utilization technology for coal gangue through waste treatment (Fig.1). It employs "dual anti-seepage, three-dimensional layering, closed isolation, and humidification compaction" for coal gangue filling. By reconstructing the particle size distribution and activating plant microbes to prepare soil and organic fertilizers, it supports ecological restoration and land reclamation in abandoned mines. This approach addresses the ecological consumption of coal gangue and provides essential filling materials for restoring abandoned land, ultimately creating usable reclaimed land or mining industrial parks.

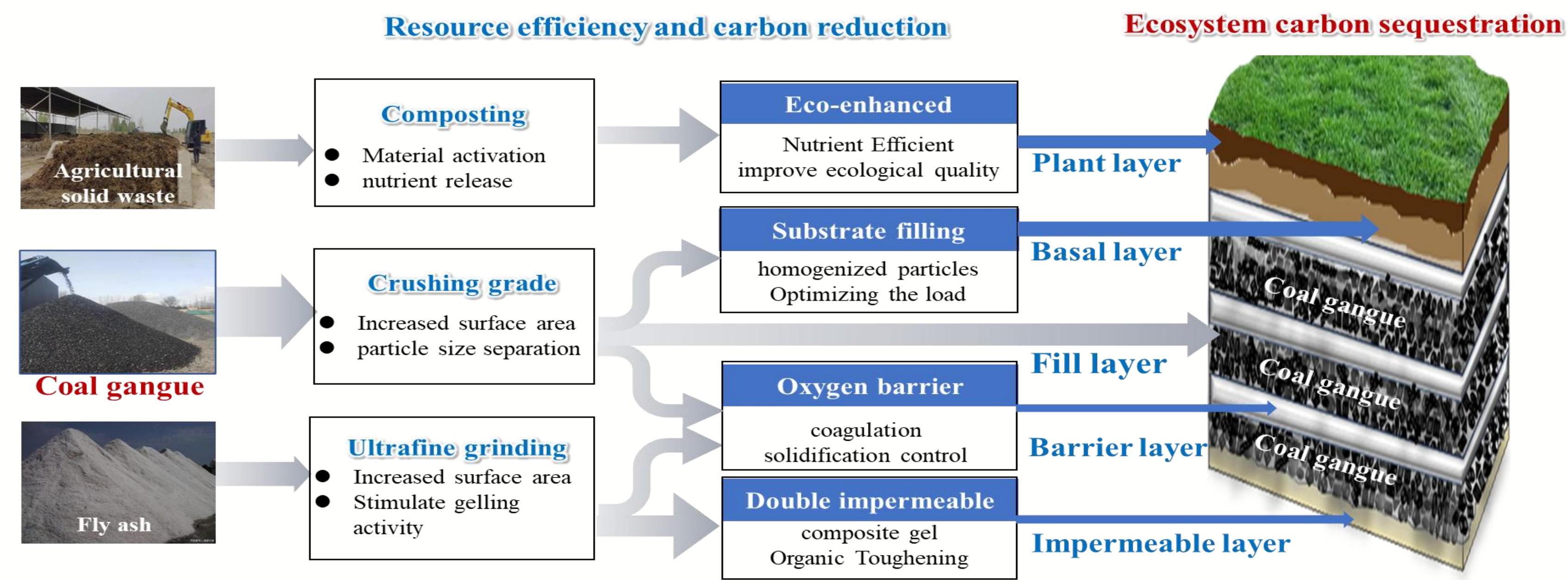


Fig. 1 Innovative eco-restoration in mining areas via “waste on waste” treatment

Technical, economic and social contributions, applications

Based on colloidal interface chemistry, create a Ca^{2+} bridging crosslinking structure, breakthrough organic-inorganic interface compatibility technology, and develop a double sealing seepage prevention material with gelling curing and coating film blocking, with ash doping of approximately 60% (Fig.2a). Fly ash high f-CaO water hardness, hydration products coated in the gangue surface to play the role of oxygen barrier (Fig.2b). Additionally, the "Green Bank" technology for artificial soil highlights the interaction among coal gangue, plants, microbes, and nutrients. This innovative approach not only effectively utilizes solid waste but also aids in the restoration of mining areas, promoting ecological balance and sustainable land use (Fig.2d). Furthermore, it activates the organic matter in gangue using high-efficiency microbial agents to produce a porous, slow-release organic fertilizer(Fig.2e).

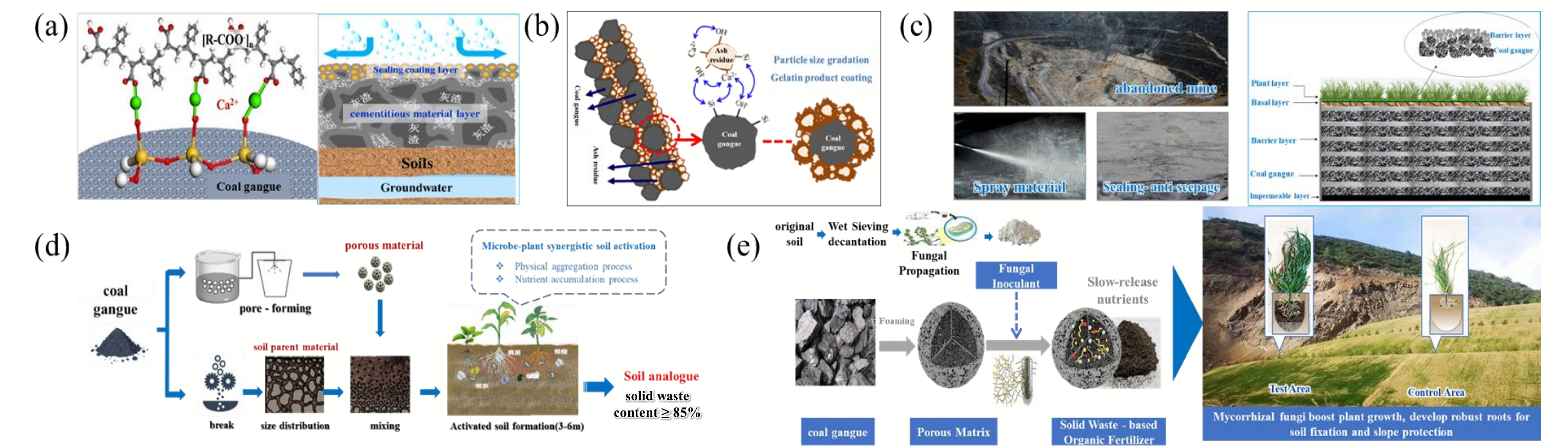


Fig. 2 (a) Dual impermeability mechanism, (b) Oxygen barrier flame retardant mechanism, (c) Material application, (d) Preparation and application of artificial soil, (e) Preparation and application of porous organic fertilizers.

The integrated technology was applied to over 100 solid waste yards and abandoned mines. It restored 13.33 square kilometers, disposed of over 10 million tons of solid waste, and achieved a vegetation coverage of over 83%. The self maintenance and self improvement of the restored mining area ecosystem have achieved significant social, economic, and ecological benefits.

Development Prospect

The promotion and application of this project can not only solve the problem of ecological scale consumption of coal gangue, but also solve the problem of filling materials required for ecological restoration of abandoned land, and ultimately form usable reclaimed land or mining industrial parks, helping to achieve the dual carbon goal. It significantly enhances its added value and holds promising market prospects.

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