

Integrating CCPs into Construction Materials: MIDHCO's Implementation Experience in the Middle East Mining Sector

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Abstract : The effective management of Coal Combustion Products (CCPs) has become increasingly important as the construction industry seeks sustainable solutions. This paper presents a comprehensive approach to CCP utilization in construction applications at the Middle East Mines & Mineral Industries Development Holding Company (MIDHCO), detailing the systematic transition from conventional disposal methods to innovative resource recovery practices. The study addresses technical challenges and practical solutions in implementing CCP recovery and usage within the specific context of Middle Eastern construction and environmental requirements. The research documents the evolution from traditional disposal methods to an integrated CCP management approach, with particular emphasis on quality control protocols and diverse construction applications. Through careful implementation of established processing techniques and innovative modifications, reliable methodologies for CCP recovery have been developed that align with current construction standards while maintaining stringent environmental compliance requirements. The approach incorporates both laboratory-scale validation and full-scale implementation studies, ensuring practical viability across different construction scenarios. The investigation presents detailed results in three key areas: (1) standardization of CCP quality for concrete applications, including physical and chemical characterization methods, particle size distribution optimization, and performance validation protocols; (2) processing methods specifically adapted to regional conditions, accounting for local climate effects, available technology, and market requirements; and (3) practical integration of CCPs into construction materials, with emphasis on workability, strength development, and durability characteristics. The findings provide valuable insights into establishing effective CCP management systems that successfully balance technical requirements with environmental considerations and economic viability. The study details a comprehensive quality monitoring system for CCP assessment, incorporating real-time analysis techniques and automated sampling procedures, alongside the implementation of waste reduction initiatives at production sites. Data from a three-year implementation period demonstrates consistent achievement of technical specifications and environmental targets. Results include achieving a sustainable 15% cement replacement rate in concrete applications while maintaining required performance specifications, successful utilization of CCPs in controlled low-strength materials for specific construction applications, and development of standardized quality control procedures adaptable to various production scales. The research quantifies environmental benefits, including reduced CO₂ emissions through cement replacement and decreased landfill requirements, while addressing practical challenges such as transportation logistics and storage requirements.

Keywords : coal combustion products (CCPs), sustainable construction, waste management, construction materials

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