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Refuse-derived fuel in cement manufacturing: a systematic review of research trends, gaps and future research directions

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Abstract

Purpose – This study provides a comprehensive overview of refuse-derived fuel (RDF) as a sustainable alternative for cement co-processing, highlighting its role in decarbonising the cement industry and advancing circular economy (CE) objectives.

Design/methodology/approach – A systematic literature review was conducted following the preferred reporting items for systematic reviews and meta-analyses guidelines to synthesise existing knowledge. A total of 211 scholarly articles (1991–July 2025) were subjected to descriptive analysis. 48 records, including seven regulatory documents, were selected for detailed content analysis.

Findings – The descriptive analysis indicates that research output on RDF in cement manufacturing has fluctuated but is showing an upward trend, driven by regulatory pressure and growing industry interest. Studies are concentrated in developed nations, with regions such as Africa and Latin America being underrepresented. Content analysis reveals ongoing ambiguity between RDF and solid recovered fuel, as these terms are often used interchangeably in research and regulations. This review clarifies RDF's role within the CE framework and the waste management hierarchy, while identifying key gaps in standardisation, quality assurance, environmental assessment and policy development. Addressing these gaps is critical to advancing sustainable global adoption.

Originality/value – This study systematically maps the evolution and current landscape of RDF research in cement manufacturing, offering a clear research agenda. By identifying critical knowledge gaps and proposing future directions, it provides a valuable reference for academics, policymakers and industry practitioners. The findings aim to inform decision-making, support the integration of RDF into cement manufacturing and contribute to global sustainability and decarbonisation efforts.

Keywords Cement manufacturing, Circular economy, Co-processing, Refuse-derived fuel, Solid recovered fuel, Waste management hierarchy

Paper type Literature review

1. Introduction

Cement is the world's most widely used construction material, forming the backbone of modern infrastructure and the built environment. Its indispensable role has led to sustained

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growth in global demand (Uratani and Griffiths, 2023). However, cement manufacturing is also one of the most carbon-intensive industries, accounting for an estimated 8% of total annual anthropogenic carbon dioxide (CO_2) emissions (Moumin *et al.*, 2020) and ranking as the third-largest source of global CO_2 emissions (Andrew, 2018, 2019). This significant carbon footprint arises primarily from two sources: the release of CO_2 during the calcination of limestone in clinker production and the extensive combustion of fossil fuels required to heat rotary kilns to high temperatures (Benhelal *et al.*, 2013; Bosoaga *et al.*, 2009; Gao *et al.*, 2015; Wojtacha-Rychter *et al.*, 2021). Traditionally, cement kilns have relied on fossil fuels, notably coal and petroleum coke, as their primary sources of thermal energy, making them significant contributors to the industry's greenhouse gas emissions (Belbute and Pereira, 2020; Benhelal *et al.*, 2013). As the urgency to address climate change intensifies, reducing emissions from cement manufacturing has become a critical sustainability priority.

Among various decarbonisation strategies, including carbon capture and storage, process optimisation and clinker substitution (Amiri and Vaseghi, 2015; Atmaca and Atmaca, 2022; Çimen, 2021; van Deventer *et al.*, 2021; Poerner and Rimpel, 2017), fuel substitution using alternative fuels, particularly refuse-derived fuel (RDF), has emerged as a practical and scalable pathway (Bień, 2021; Güereca *et al.*, 2015). Within the broader cement manufacturing process, the simultaneous use of RDF alongside conventional fossil fuels during clinker production is referred to as *co-processing* (Long *et al.*, 2022). RDF co-processing offers dual benefits: reducing fossil fuel dependence and diverting waste from landfill, thereby supporting climate mitigation, sustainable waste management and circular economy (CE) objectives (Chandrasekhar and Pandey, 2020; Imbabi *et al.*, 2012). In this context, RDF represents a critical interface between waste management systems and industrial decarbonisation efforts.

Despite the growing interest in RDF as an alternative fuel, its co-processing in cement manufacturing remains underexplored within sector-specific literature reviews. Existing reviews have largely focused on RDF production systems or technology-specific feasibility, with limited attention to its application within cement manufacturing as an integrated system. For instance, Tahir *et al.* (2024) reviewed sustainable RDF production in waste-processing facilities, focusing on municipal solid waste (MSW) treatment systems rather than end-use applications in cement kilns. Similarly, Chavando *et al.* (2022) offered a broad overview of RDF characteristics and applications, while Shehata *et al.* (2022) examined RDF in the context of CE and the Sustainable Development Goals, without addressing cement-sector-specific operational dynamics. More targeted reviews, such as Sharma *et al.* (2022) and Tihin *et al.* (2023), remain predominantly technology-oriented, emphasising combustion processes, feedstock preparation and kiln compatibility.

As a result, the existing literature lacks a comprehensive, sector-specific synthesis that integrates the conceptual, regulatory and sustainability dimensions of RDF co-processing in cement manufacturing. In particular, inconsistencies remain in how RDF and solid recovered fuel (SRF) are conceptualised within the literature. While SRF is frequently discussed alongside RDF in cement-kiln fuel substitution studies and is commonly treated as a waste-derived fuel (Chavando *et al.*, 2022; De Gisi *et al.*, 2018), variations in terminology and regulatory interpretation contribute to an inconsistent understanding of the field. Although RDF is widely recognised as a sustainable waste-to-energy (WtE) solution that supports CE objectives (Shehata *et al.*, 2022), existing studies have not explicitly positioned RDF within the combined context of CE principles and the waste management hierarchy (WMH), particularly in relation to cement-kiln co-processing. This limitation is important because RDF utilisation in cement kilns is influenced not only by fuel properties and technological feasibility, but also by operational requirements, policy frameworks and broader sustainability considerations. Without a more integrated perspective, current knowledge remains insufficient to support coherent academic understanding and effective large-scale implementation within the cement sector. To position the contribution of the present study, Table 1 summarises the key

Table 1. Positioning the present review against key prior review studies

Study	Scope	Methodology	Key findings/focus	Limitation	Future direction implied
Chavando *et al.* (2022)	Broad RDF landscape	Snapshot review	Reviews RDF characteristics, production and application trends	Not cement-specific; limited focus on regulatory positioning and research agenda	Need sector-specific synthesis of cement manufacturing
Shehata *et al.* (2022)	RDF, circular economy and SDGs	Narrative review	Explains RDF's sustainability role and broader policy relevance	Does not focus specifically on cement manufacturing operations or kiln-level implications	Need operational and cement-sector implications
Sharma *et al.* (2022)	RDF co-processing in cement production	Technical review	Compares direct firing and RDF gasification options for cement production	Technology-centred; limited coverage of CE, waste management hierarchy and policy dimensions	Need integration of policy, CE and standardisation dimensions
Tihin *et al.* (2023)	MSW-derived RDF for cement co-processing	Overview/ review	Summarises feedstock quality, preparation and cement kiln compatibility	Primarily technical; does not provide a broader sector-specific research agenda	Need broader research agenda beyond technical feedstock issues
Tahir *et al.* (2024)	Sustainable RDF production in waste processing facilities	Critical review	Focuses on RDF production systems and process sustainability	End-use in cement manufacturing is not the core analytical focus	Need end-use review focused on cement manufacturing
Present study	RDF in cement manufacturing	Systematic literature review	Combines descriptive and content analysis to clarify RDF/SRF distinctions, sectoral relevance, CE/WMH positioning and future research directions	Provides a cement-sector-specific synthesis and research agenda	Provides an integrated agenda for future study

Source(s): Authors' own work

characteristics, contributions and limitations of major review studies identified in the literature.

As illustrated in Table 1, existing review studies have provided valuable insights into RDF production systems, combustion technologies, sustainability implications and waste-management applications (Chavando *et al.*, 2022; Shehata *et al.*, 2022). However, existing reviews remain fragmented in scope and predominantly technology-oriented, with limited attention given to the conceptual distinction between RDF and SRF, regulatory frameworks governing RDF utilisation and the positioning of RDF within CE and WMH frameworks specifically in the context of cement manufacturing. Moreover, current reviews have not developed a comprehensive sector-specific research agenda that integrates these dimensions within a unified analytical framework. Therefore, there remains a clear need for a comprehensive, sector-specific systematic review that integrates the conceptual, regulatory, sustainability and research and development dimensions of RDF co-processing in cement manufacturing. Addressing these gaps is particularly important for supporting the sustainable integration of RDF within cement manufacturing systems and for guiding future research, policy development and industrial implementation.

Accordingly, the aim of this study is to systematically review and synthesise the current state of knowledge on RDF co-processing in cement manufacturing, with particular attention to RDF/SRF conceptualisation, regulatory frameworks, CE positioning and future research directions.

Within this context, the following research questions are proposed:

RQ1. What is the current state of the art of research on RDF co-processing in cement manufacturing?

RQ2. How are RDF and SRF conceptualised and regulated within the context of cement manufacturing?

RQ3. How is RDF positioned within circular economy and waste management frameworks in cement manufacturing?

RQ4. What are the future research directions for advancing RDF use in cement manufacturing?

The study, therefore, seeks to advance a more coherent understanding of RDF co-processing by addressing conceptual fragmentation and developing an integrated, sector-specific research agenda for cement manufacturing. The remainder of the paper is structured as follows. Section 2 outlines the methodology adopted for the systematic literature review (SLR). Section 3 presents the findings and discussion of the review. Section 4 discusses future research directions and develops a research agenda. Finally, Section 5 concludes the study.

2. Methodology

This study conducted an SLR, a legitimate method for conducting an extensive review of the literature to frame a research area (Azarian *et al.*, 2023). An SLR provides a structured framework for evaluating, classifying, selecting and critically assessing prior studies to create new knowledge (Azarian *et al.*, 2023; Khaw *et al.*, 2024; Yildizbasi *et al.*, 2025). Since SLRs are based on a strict set of guidelines, the process followed is scientific, transparent and replicable (Tranfield *et al.*, 2003). Accordingly, this SLR intends to capture scattered knowledge on the use of RDF in cement manufacturing to generate new insights. This review follows the five-step approach for conducting SLRs proposed by Denyer and Tranfield (2009) (see Figure 1), which has been used successfully in previous SLRs (Ali *et al.*, 2017; Tennakoon *et al.*, 2022, 2023).

The subsequent sections provide a comprehensive explanation of each step.

2.1 Step 01: question formulation

A well-formulated review question is fundamental to shaping the direction of an SLR, as it determines the inclusion criteria, guides the development of the search strategy and defines the scope of data extraction (Denyer and Tranfield, 2009). Accordingly, the present study is guided by four review questions, previously introduced in Section 1 and reiterated here for clarity: *RQ1: What is the current state of the art of research on RDF co-processing in cement manufacturing?*, *RQ2: How are RDF and SRF conceptualised and regulated within the context of cement manufacturing?*, *RQ3: How is RDF positioned within circular economy and waste management frameworks in cement manufacturing? and RQ4: What are the future research directions for advancing RDF use in cement manufacturing?*.

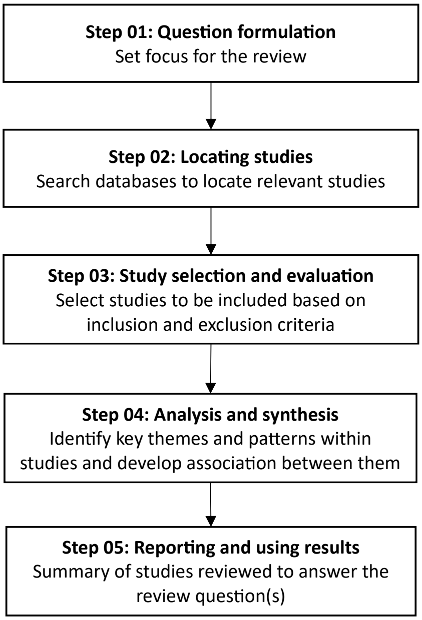

Figure 1. Five-step approach for conducting SLR. Source: Adopted from (Denyer and Tranfield, 2009):

2.2 Step 02: locating studies

The process of locating relevant studies began with selecting appropriate databases and keywords. Several academic databases, including Emerald Insight, Web of Science (WoS), Scopus, ScienceDirect and Taylor and Francis, were initially evaluated for their relevance and coverage. Among them, Scopus and WoS yielded the highest number of relevant results and are widely recognised for their multidisciplinary scope and inclusion of peer-reviewed literature (Zhu and Liu, 2020). Ultimately, WoS was selected as the primary database for this study due to its rigorous inclusion criteria and emphasis on academic quality (Li *et al.*, 2018).

The search string was developed through an initial scoping review of studies related to RDF, SRF, waste-to-energy (WtE) and cement manufacturing to ensure alignment with the research questions. The search terms were structured around three main concept groups: (1) RDF/SRF terminology, (2) energy and waste recovery terminology and (3) cement-sector terminology. Although this review is primarily framed around RDF, the scope also includes SRF because it is frequently discussed alongside RDF in cement-kiln fuel substitution studies and is commonly regarded as a more standardised form of waste-derived fuel (Chavando *et al.*, 2022; De Gisi *et al.*, 2018). Accordingly, both “solid recovered fuel” and “SRF” were included as keywords to ensure comprehensive coverage of relevant studies.

The term “co-processing” was not included as a mandatory standalone search term. Preliminary scoping indicated that relevant studies were already captured through combinations of cement-sector and energy-related keywords. Furthermore, many studies examining RDF utilisation in cement kilns refer more broadly to alternative fuels, energy recovery, clinker production, or fuel substitution rather than explicitly using the term “co-processing” (Genon and Brizio, 2008; Hemidat *et al.*, 2019; Patel and Chauhan, 2014). Therefore, broader cement manufacturing and energy-recovery terminology was adopted to ensure comprehensive coverage of studies related to RDF utilisation within cement manufacturing and cement-kiln fuel substitution. The final search string used in the database is presented as follows:

(("refuse derived fuel" OR rdf OR "alternative solid fuel" OR "solid refuse fuel" OR "waste-derived fuel" OR "secondary fuel" OR "solid recovered fuel") AND ("energy recov*" OR "waste recov*" OR recov* OR "waste to energy" OR wte OR "energy from waste" OR efw OR "renewable energy" OR energy) AND (cement OR "cement industr*" OR "cement manufacturing"))

The search string above is presented exactly as entered in the database to improve transparency and reproducibility. In line with bibliometric evidence from Sarquah *et al.* (2022), which indicates that RDF-related literature began emerging around 1991, the search period was set from 1991 to July 2025 to ensure comprehensive coverage of the research landscape.

2.3 Step 03: study selection and evaluation

The preferred reporting items for systematic reviews and meta-analyses (PRISMA) was used as a guideline for documenting the study selection process. It assists in planning the study in a way to improve the transparency, accuracy, quality and completeness of the review (Moher *et al.*, 2009). Figure 2 presents a simplified depiction of the PRISMA flow diagram, which is used in this study.

"ALL" fields from the WoS database were searched using the search string established earlier. Accordingly, the initial search resulted in 218 articles. Before proceeding to the screening, seven records written in languages other than English were removed. Therefore, 211 English-language records published between 1991 and July 2025 were retained for

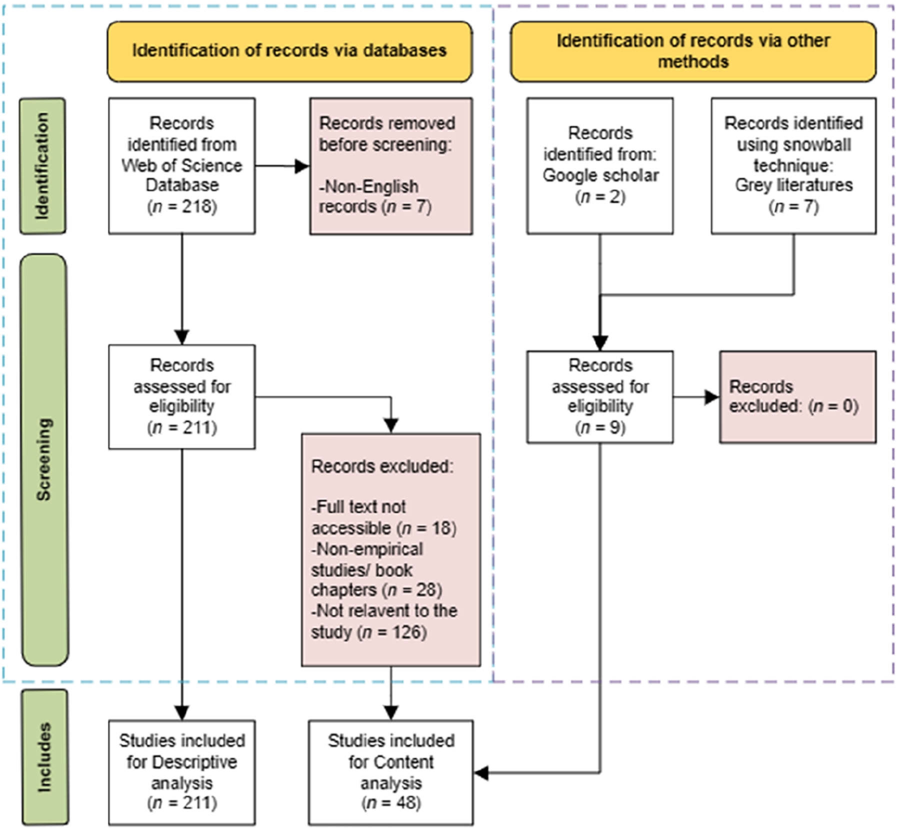

Figure 2. PRISMA-guided flow diagram for the searching and screening process. Source: Authors' own work

descriptive analysis. At the screening stage, titles, abstracts and conclusions were systematically reviewed to assess relevance to the review questions and the cement manufacturing context (Davey *et al.*, 2011). Studies were retained if they explicitly addressed RDF or SRF utilisation, energy-recovery applications, or cement-kiln-related processes. Records were excluded at this stage if they focused on unrelated sectors, did not involve cement-based applications, or lacked sufficient information to determine relevance. This stage served as a preliminary filtering step prior to full-text assessment.

A comprehensive screening process was conducted on 211 records to select articles for content analysis. 18 inaccessible articles and 28 review or book chapter articles were excluded to minimise overlap and potential bias in the full-text synthesis. A further 126 articles were removed as they did not meet the inclusion criteria related to RDF use in cement manufacturing. Specifically, studies were excluded if they: (1) focused on RDF production, waste management, or energy recovery without reference to cement kiln applications, (2) examined RDF utilisation in non-cement sectors such as agriculture, general manufacturing, or power generation or (3) did not provide sufficient evidence of RDF integration within cement manufacturing processes. Relevance was determined based on whether the study explicitly addressed RDF or SRF use in cement kilns, clinker production, or cement-related energy substitution. This process resulted in 39 articles being selected for full-text review.

To enhance the completeness of the dataset, a secondary search was conducted using Google Scholar to identify potentially relevant studies not captured in the WoS database, particularly recent publications and non-indexed academic sources. Google Scholar was selected due to its broader indexing coverage, including grey literature and early-access publications that may not yet be indexed in WoS, thereby reducing the risk of database bias. This approach is consistent with prior systematic review studies by Kabirifar *et al.* (2020) and Tennakoon *et al.* (2023). In parallel, a snowballing technique was employed through backward and forward citation tracking to identify additional relevant sources (Erdiaw-Kwasie *et al.*, 2024). This approach was particularly useful for identifying regulatory and policy-related documents referenced within the reviewed studies (Evans *et al.*, 2012; O'Connor *et al.*, 2024). Accordingly, seven regulatory documents were incorporated as grey literature to capture sector-specific regulatory perspectives that are not typically represented in peer-reviewed journal databases. Grey literature refers to materials produced outside traditional academic publishing and indexing systems, including policy documents, industry reports and other non-indexed scholarly outputs (Benzies *et al.*, 2006; El jaouhari *et al.*, 2025; Mahood *et al.*, 2014). Such sources are particularly valuable in applied fields, as they provide critical insights into regulatory frameworks and policy actions that are often underrepresented in academic literature. The inclusion of grey literature therefore enhances the contextual relevance of the review. The combined process resulted in a final dataset of 48 records for full-text review and subsequent content analysis (refer to Figure 2).

2.4 Step 04: analysis and synthesis

Informed by Grant and Booth (2009), the results of this SLR are presented in two categories: descriptive analysis and content analysis. The descriptive analysis of the articles offers a solid foundation for subsequent content analysis (Vaismoradi *et al.*, 2013). The articles were organised by year of publication, geographic contribution and keyword frequency to address RQ1. In the content analysis, the selected articles were synthesised into distinct themes using an inductive approach to address RQ2 and RQ4.

2.5 Step 05: reporting and using results

Strategies should be implemented to enhance the study's trustworthiness and analytical rigour (Thisakya and Dissanayake, 2026). Potential bias in study selection and reporting was minimised by involving four researchers. Initially, the first researcher selected, evaluated and analysed the review findings. Any ambiguities that arose in this process were resolved with the involvement of the other three researchers.

3. Findings and discussion

Findings from the descriptive and content analyses are presented in this section.

3.1 Results of descriptive analysis

The distribution of publications based on the year (Section 3.1.1), geographical location (Section 3.1.2) and co-occurrences of keywords (Section 3.1.3) was analysed under the descriptive analysis to discern trends in research on the use of RDF.

3.1.1 Publications over time. Figure 3 illustrates the annual distribution of publications related to RDF in cement manufacturing. Although previous studies have identified RDF-related publications as early as 1991 (Sarquah *et al.*, 2022), no publications from1991 that met the scope and inclusion criteria of the present review were identified. Accordingly, the earliest relevant publication included in this review was published in 1992. Research output remained relatively low and sporadic until a noticeable rise after 2013. Since then, publication numbers have fluctuated, with dips in 2017, 2019 and 2022, yet the overall trajectory has been upward, culminating in a peak of 24 publications in 2023. Over 80% of the reviewed articles (f = 173) were published within the past 11 years, demonstrating strong and sustained research growth despite short-term fluctuations. This trend is consistent with previous studies highlighting increasing global pressure on the cement industry to reduce greenhouse gas emissions and transition toward alternative fuel systems (Benhelal *et al.*, 2013; van Deventer *et al.*, 2021; Farfan *et al.*, 2019). With eight articles already published in 2025, this trend suggests continued academic and industrial interest in sustainable practices within the cement manufacturing sector.

3.1.2 Contribution of countries. Figure 4 presents the global distribution of RDF-related research in cement manufacturing, categorised by colour gradient to indicate publication frequency (1–29). China leads with the highest number of publications (f = 29), followed by Germany (f = 21), Poland (f = 19) and Brazil (f = 12). Europe emerges as a central hub, with substantial contributions from the UK, Italy, the Netherlands and Austria. The strong European contribution may reflect the region's long-standing policy emphasis on waste recovery, landfill diversion, CE implementation and alternative fuel utilisation within energy-intensive

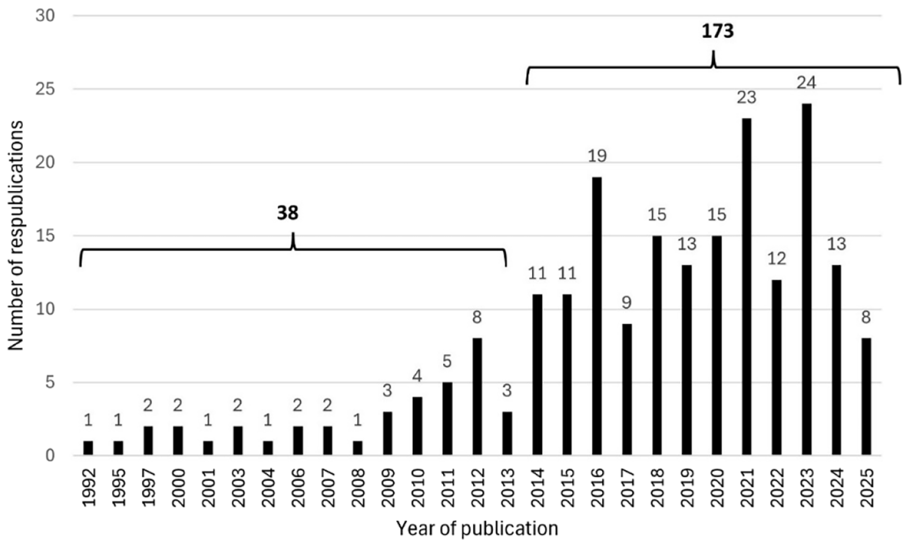

Figure 3. The trend of articles published during 1991–2025. Source: Authors' own work

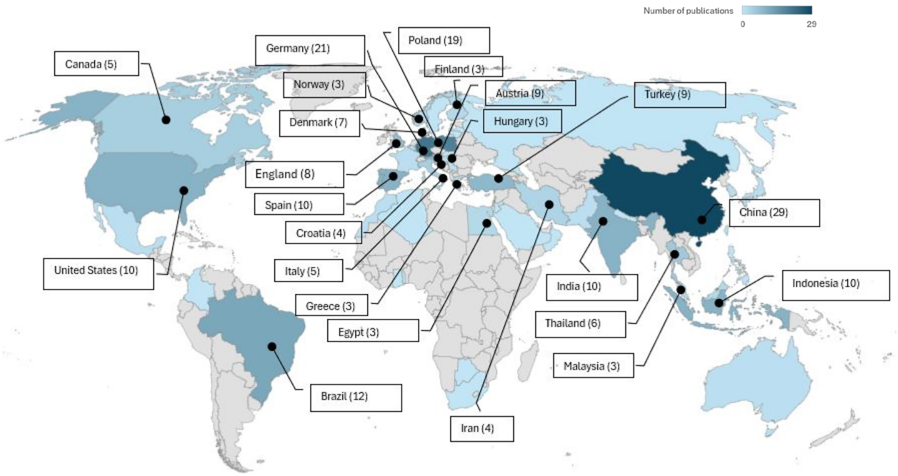

Figure 4. Distribution of research articles by country of research. Source: Authors' own work]

industries (Deja *et al.*, 2010; European Union, 2010; Garg *et al.*, 2007). In contrast, research output from Africa and parts of the Middle East remains minimal. This disparity highlights an imbalance in global research efforts, with developed nations dominating the discourse while underrepresented regions, despite their potential for RDF adoption, remain largely overlooked. Co-occurrences of keywords.

3.1.3 Co-occurrences of keywords. Keyword co-occurrence analysis is an effective method for uncovering core themes, research trends and focal areas within a body of literature (Grames *et al.*, 2019). Using VOSviewer, co-occurrence analysis was performed on 211 articles, generating a network map based on 59 keywords with a minimum threshold of five occurrences. The resulting map includes 749 links and a total link strength of 1,506, as illustrated in Figure 5.

The co-occurrence map is divided into four main clusters, highlighted by colour: red, green, blue and yellow, representing the key research themes identified in the literature-namely MSW management and CE (cluster 1-red), combustion technologies and thermal processing (cluster 2-blue), alternative fuels in the cement manufacturing industry (cluster 3-green) and cement kiln efficiency and emission control (cluster 4-yellow).

Figure 6 illustrates the interrelationships of the keyword *"refuse-derived fuel"* from Cluster 1 with other clusters, as well as the keyword *"solid recovered fuel"* from Cluster 3 and its connections to other clusters.

As shown in Figures 6a and 6b are positioned centrally within the network of co-occurring keywords, with numerous direct connections to other important concepts, including waste, combustion, energy, emissions, alternative fuels, CE, sustainability and the cement industry. This central position suggests that much of the academic and industrial discussion centres on these two keywords, focusing on concepts of CE and sustainable waste management. This knowledge sets the stage for a detailed analysis of RDF and SRF, their unique features and their role as enablers in advancing CE and sustainable waste management goals. Consequently, this provides a strong foundation for the following sections, in which these themes are integrated into a comprehensive narrative, contributing to a deeper understanding and paving the way for future research.

3.2 Content analysis

This section presents insights derived from 48 publications retrieved through a comprehensive review of the full-text literature, grey literature and Google Scholar search outputs (refer to

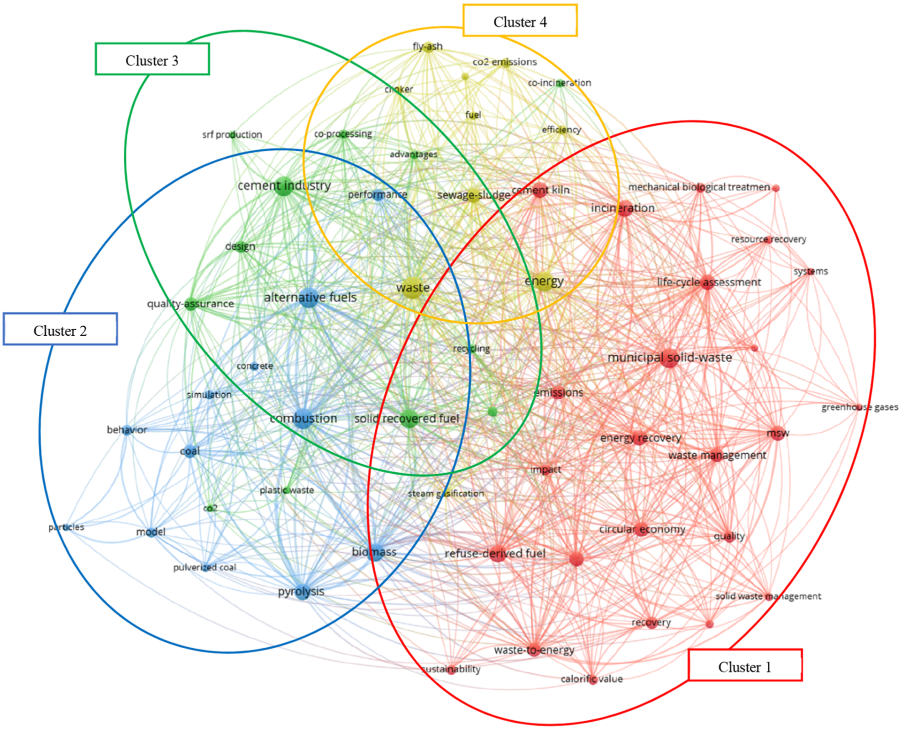

Figure 5. Illustration of a keyword co-occurrence map. Source: Authors' own work

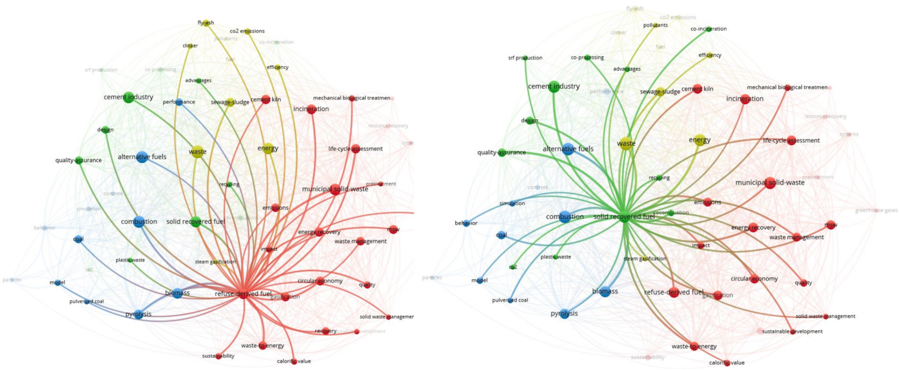

Figure 6. Illustration of interrelationships of (a) RDF, (b) SRF. Source: Authors' own work

Appendix A). Although the review is framed primarily around RDF, SRF is included within the analytical scope because it represents a standardised subset of RDF and is frequently discussed alongside RDF in studies on cement-kiln fuel substitution. The section is organised to represent a holistic overview of RDF co-processing in cement manufacturing, with the identified themes divided into the following sections: (1) the difference between RDF and SRF (Section 3.2.1), (2) legal regulations related to RDF/SRF (Section 3.2.2) and (3) RDF as an enabler of CE and sustainable waste management (Section 3.2.3).

3.2.1 The difference between RDF and SRF. In cement industry literature, the term RDF is more commonly used than SRF when discussing its uptake. This trend is evident in studies by Patel and Chauhan (2014), Hemidat *et al.* (2019), Tihin *et al.* (2023) and Paramita *et al.* (2018). Many high-calorific waste materials are labelled as RDF; however, their compositional quality and environmental characteristics often remain unclear (De Gisi *et al.*, 2018). Although previous research has acknowledged the confusion caused by the interchangeable use of RDF and SRF (Chavando *et al.*, 2022; De Gisi *et al.*, 2018), the rational response is yet to be discovered.

Both RDF and SRF offer advantages over untreated waste, including higher calorific values, reduced moisture content and improved particle uniformity with lower metal contamination. However, SRF is primarily distinguished by its compliance with specific international quality standards, such as ISO 21640:2021, whereas RDF typically lacks such standardisation (De Gisi *et al.*, 2018; Psaltis and Komilis, 2019). As such, applying these standards remains a practical approach to differentiate between the two fuel types in both academic and industrial contexts.

Standardisation refers to the development of specifications for key product attributes to ensure consistent quality and performance (Jones and Hudson, 1996). As a fundamental component of quality management, effective standardisation builds trust among suppliers, end-users and regulatory authorities (Central Public Health and Environmental Engineering Organisation, 2018). This is particularly important for waste-derived fuels such as RDF, which originate from heterogeneous MSW and are therefore subject to significant compositional variability. The most discussed standards in the literature are identified below.

(1) *ISO 21640:2021 "Solid recovered fuels–Specifications and classes"*

Among the most widely cited standards in the literature is ISO 21640:2021 *"Solid Recovered Fuels–Specifications and Classes."* This international standard offers a comprehensive framework for classifying SRF. It is considered a global extension of EN 15359:2011, the earlier European standard developed by the European Committee for Standardisation (CEN/TC 343) (Central Public Health and Environmental Engineering Organisation, 2018). Both standards categorise SRF into five classes based on three primary fuel properties: net calorific value, chlorine (Cl) content and mercury (Hg) content. However, ISO 21640:2021 is broader in scope, placing greater emphasis on mercury limitations and incorporating additional parameters such as particle size, ash content, moisture and pollutant levels (e.g. halogens and heavy metals), making it more applicable to contemporary regulatory and environmental demands (European Investment Bank, 2024; Del Zotto *et al.*, 2015). While both standards provide a foundational basis for SRF classification, ISO 21640:2021 is generally viewed as more robust due to its global applicability, enhanced environmental criteria and expanded classification metrics. The classification system defined under ISO 21640:2021 is summarised in Table 2.

Classes 1, 2 and 3 of the ISO 21640:2021 standard represent the most desirable SRFs for use in cement plants, offering optimal performance in terms of economic efficiency (LHV >15 MJ/kg), technological compatibility (Cl $\leq$ 1.0%) and environmental safety (Hg 80th percentile <0.10 mg/MJ). In contrast, fuels classified under classes 4 and 5 are generally considered of lower value for such applications (European Investment Bank, 2024; Kahawalage *et al.*, 2023; Santos *et al.*, 2023; Sarquah *et al.*, 2022a, b).

Despite the clarity offered by ISO 21640:2021 and its predecessor EN 15359:2011, the classification of SRF remains a source of confusion in the literature. Several studies have incorrectly referred to these standards as RDF classifications, even though they explicitly define specifications for SRF (Bień, 2021). This terminological ambiguity extends further, with some researchers referring to SRF classes as "RDF classes" or broadly categorising all waste-derived fuels as SRF without formal classification. Moreover, fuels that meet ISO

Table 2. Classes of SRF according to ISO 21640:2021

Classification characteristics	*Statistical measures*	*Unit*	*Classes* 1	2	3	4	5
NCV (economics)	mean	MJ/kg	≥25	≥20	≥15	≥10	≥3
Cl (technological)	mean	% in mass (dm)	≤0.2	≤0.6	≤1.0	≤1.5	≤3
Hg (environmental)	median	mg/MJ	≤0.02	≤0.03	≤0.05	≤0.10	≤0.15
	80th percentile	mg/MJ	≤0.04	≤0.06	≤0.10	≤0.20	≤0.30

Note(s): dm = dry matter
Source(s): Authors' own work

21640:2021 requirements are sometimes mislabelled as RDF, despite the standard classifying them as SRF (Gałko *et al.*, 2023; Mateus *et al.*, 2023; Sarquah *et al.*, 2022a, b). In some cases, the use of "RDF" as a general term is deliberate, intended to simplify communication, since SRF is technically a refined subset of RDF (Sakri *et al.*, 2021; Sarquah *et al.*, 2022a, b). This conceptual relationship among waste, RDF and SRF is illustrated in Figure 7.

It is important to note that SRF and RDF differ in terms of classification and quality standards; however, the choice of which to use for cement co-processing ultimately lies with the end-user. Both RDF and SRF are suitable for this application, depending on specific operational requirements and regulatory contexts. This study, therefore, considers SRF within the broader RDF framework, recognising it as a standardised subset rather than a separate category.

3.2.2 Legal regulations related to RDF/SRF. In addition to classification standards, various legal regulations govern the use of RDF and these differ by country or region, reflecting the legislative authority of local or supranational bodies. Notably, the EU has implemented several key directives and regulations to formally address the use and management of RDF. For

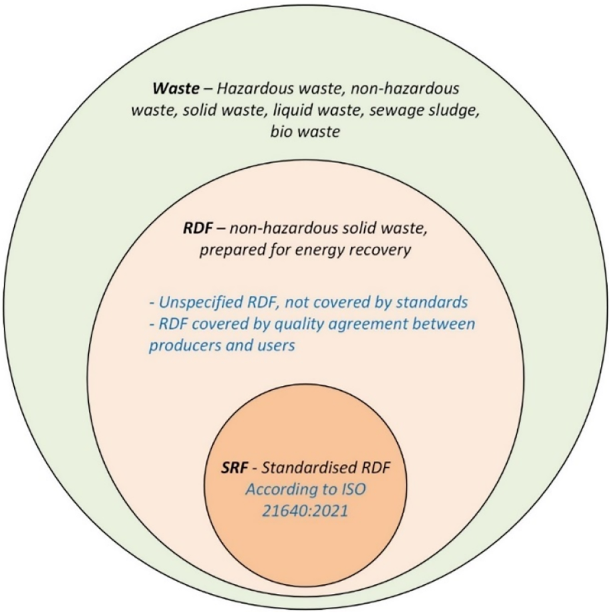

Figure 7. The interconnection between waste, RDF and SRF. Source: Authors' own work

cement manufacturing, these regulations are particularly important because they shape fuel acceptance criteria, emissions compliance, cross-border movement of waste-derived fuels and the permitting environment within which cement kilns operate. Table 3 summarises some of the most relevant EU legal instruments applicable to RDF. These regulatory frameworks are particularly significant for cement manufacturing, as they directly govern the conditions under which RDF can be utilised as an alternative fuel in kiln operations.

Beyond the EU, several countries have established national legislation to govern the production, classification and utilisation of RDF in various applications. In Germany, stricter regulatory frameworks distinguish RDF from SRF, reflecting rigorous emission control and energy recovery requirements (Gałko *et al.*, 2023). In the USA, RDF is regulated under the Clean Air Act and the Resource Conservation and Recovery Act, both of which prioritise emissions management and the safe handling of potentially hazardous waste materials (Shehata *et al.*, 2022). Indonesia has adopted policy incentives such as feed-in tariffs to support RDF-based WtE initiatives, alongside reinforced regulations for MSW management (Mateus

Table 3. EU regulations on RDF/SRF

European Union (EU) Regulations	*Description*	*Reference*
The Packaging and Packaging Waste regulation	• As the Packaging Directive emphasises increased recycling of plastics, the availability of "non-recyclable" plastics, key RDF components, will decrease over time. Investments in chemical recycling and stricter recyclability targets will divert materials, such as polyolefins, away from RDF production	European Union (2025)
Renewable Energy Directive RED II/III	• The Renewable Energy Directive indirectly impacts RDF, as it can serve as a feedstock for the production of Recycled Carbon Fuels (RCF), which contribute to renewable energy targets • Materials within RDF, such as mixed plastics and textiles, are key components for producing liquid or gaseous RCF, like methanol • The directive incentivises waste-to-energy practices by linking RDF to renewable fuel infrastructure development	European Union (2018)
EU Industrial Emissions Directive (2010/75/EU	• Regulates emissions from industrial plants using RDF as fuel, including cement kilns and waste-to-energy plants • Sets limits for pollutants like nitric oxide (NO), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), sulphur trioxide (SO_3), carbon monoxide (CO), dioxins, furans and particulate matter	European Union (2010)
EU Waste Framework Directive (2008/98/EC)	• The Waste Framework Directive's hierarchy prioritises recycling over energy recovery methods, such as RDF. However, RDF provides a solution for managing non-recyclable waste, ensuring it is diverted from landfills and used for energy recovery, aligning with the "recovery" step in the hierarchy	European Council (2013)
The Waste Shipment Regulation	• RDF is classified under specific waste codes (19 12 10 and 19 12 12) in the Waste Shipment Regulation, allowing its trade across EU borders. This classification enables RDF producers and consumers to navigate legal frameworks for transboundary shipments	European Union (2006)
Council Directive on landfill of waste (1999/31/EC)	• Prohibits the landfilling of high-calorific waste and encourages the use of RDF as a substitute fuel	European Union (1999)

Source(s): Authors' own work

et al., 2023). In Portugal, Decree-Law No. 103/2015 establishes legal guidelines for RDF classification and energy recovery, aligning with the country's national waste management objectives (Berardi *et al.*, 2020). Similarly, Brazil incorporates RDF into its industrial energy policy, promoting the use of alternative fuels to reduce landfill dependency and enhance energy efficiency (de Lorena Diniz Chaves *et al.*, 2021). In Poland, RDF is legally classified as waste, meaning that its handling, transportation and storage are subject to waste licensing requirements under the amended Waste Act of 2012 (Gałko *et al.*, 2023). Taken together, these regulatory arrangements directly influence whether and how RDF producers and cement manufacturers can produce, procure, transport and co-process RDF/SRF. In particular, they determine fuel acceptance criteria, emissions compliance thresholds, permitting requirements and cross-border waste movement, all of which are critical to the operational feasibility of RDF co-processing in cement kilns.

3.2.3 RDF as an enabler of circular economy and sustainable waste management. The WMH, formalised under the EU Waste Framework Directive (2008/98/EC), provides a globally recognised framework for ranking waste treatment strategies in order of environmental preference (Ewijk and Stegemann, 2016). The hierarchy comprises five tiers, arranged from most to least desirable: waste prevention, reuse, recycling, other recovery and disposal (Cole *et al.*, 2019; Ewijk and Stegemann, 2016). Within this structure, the EU Waste Framework Directive classifies recycling, other recovery and disposal as the final stages of waste treatment (European Council, 2013). Although the term "other recovery" is not explicitly defined, it is exemplified through energy recovery. Building on this, the UK Department for Environment Food and Rural Affairs (2011) interprets other recovery as encompassing both energy and material recovery processes aimed at extracting value from waste that cannot be reused or recycled through conventional methods. Lombardi *et al.* (2015) argue that while reuse and recycling primarily target the recovery of materials, energy recovery serves as a necessary alternative when material recovery is technically or economically unfeasible. Therefore, it can be argued that, within the WMH framework, other recoveries can be effectively interpreted as energy recovery. In the context of cement manufacturing, this framework is particularly relevant, as cement kilns offer a viable industrial pathway for energy recovery via the co-processing of non-recyclable waste-derived fuels, such as RDF (see Figure 8).

Emphasising these higher-order strategies within the WMH framework contributes to a broader conceptual shift, repositioning waste not as a terminal by-product but as a resource with potential value. This perspective closely aligns with the core principles of the CE, which aims to optimise resource efficiency, extend material lifecycles and minimise environmental impact by promoting the continual circulation of resources within the economic system (Ghisellini and Ulgiati, 2020; Johansson and Henriksson, 2020).

CE promotes a closed-loop system aimed at minimising waste and reusing resources, thereby replacing the traditional linear economy model, where resources are extracted, consumed and discarded (Ghisellini and Ulgiati, 2020; Johansson and Henriksson, 2020; Mancheri *et al.*, 2018). This transition is extensive and supported by evolving strategies. Originally founded on the 3 Rs (Reduce, Reuse and Recycle), CE has expanded into the 10 R framework: Refuse, Rethink, Reduce, Reuse, Repair, Refurbish, Remanufacture, Repurpose, Recycle and Recover (Potting *et al.*, 2017). In an ideal CE, recycled materials maintain their original quality for use in equivalent products, thus eliminating the need for additional natural resources (Potting *et al.*, 2017; Romero-Hernández and Romero, 2018). Although this form of perfect circularity, where materials can be endlessly cycled, is conceptually desirable, it is rarely achievable in practice (Genovese *et al.*, 2017; Potting *et al.*, 2017). Therefore, a pragmatic CE approach focuses on prolonging material lifespan and reducing waste generation (Neves and Marques, 2022). From a cement manufacturing perspective, this positioning highlights the role of RDF co-processing as a practical mechanism for integrating waste management and industrial production systems, thereby contributing to both resource efficiency and emission reduction targets.

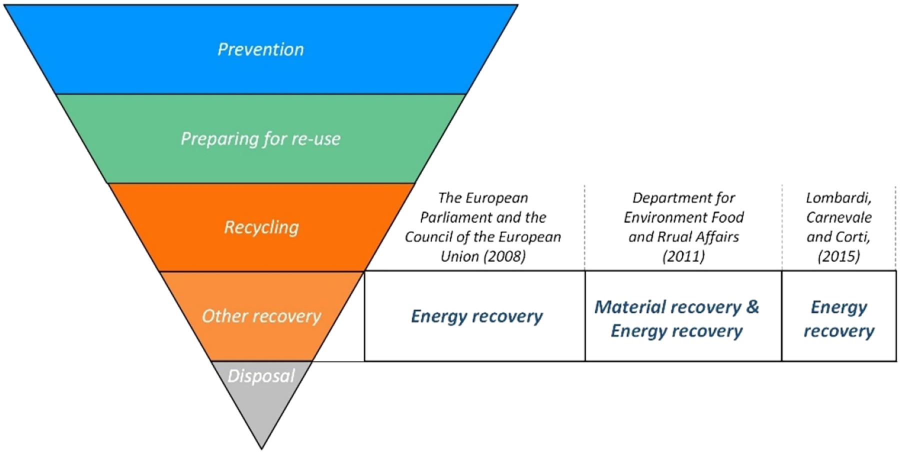

Figure 8. WMH according to the WFD 2008/98/EC and provision of energy recovery. Source: Authors' own work

In practical application, both WMH and CE converge in later stages, particularly in recycling and recovery. While recovery represents the penultimate phase in CE, WMH concludes with disposal when recovery is no longer feasible. Thus, when waste is no longer viable for reuse or recycling, recycling and recovery remain the most appropriate strategies, in accordance with CE principles, to avoid landfilling.

Certain waste materials present technical or economic challenges for recycling, such as plastic bags and films (Dey *et al.*, 2021), blended fabrics (Kahoush and Kadi, 2022; Loo *et al.*, 2023; Subramanian *et al.*, 2022) and treated wood (Van Acker *et al.*, 2023; Townsend and Anshassi, 2023). These materials can be evaluated for their calorific value and processed into energy, either directly (as primary sources) or as processed fuels like RDF/SRF (secondary sources) (Bendjedia *et al.*, 2018; Ferdan *et al.*, 2018; Forman *et al.*, 2016; Fumo and Chamra, 2010; Kaur *et al.*, 2021; Serrano *et al.*, 2024). In the specific context of cement manufacturing, RDF serves as a practical bridge between waste recovery and industrial decarbonisation by substituting fossil fuels in clinker production. This positions cement kilns as key enablers of CE implementation, particularly for waste streams that are not suitable for recycling. Accordingly, RDF co-processing represents a sector-specific application of both WMH and CE principles, translating abstract sustainability concepts into operational practices within the cement industry. Figure 9, therefore, positions RDF within the fourth tier ("other recovery") of the WMH and as the tenth strategy ("recover") in the 10 R CE framework.

4. Future research directions

As illustrated in Figure 10, the research gap and future research agenda mapping diagram establishes explicit linkages between the findings of the content analysis and the proposed research directions, thereby providing a structured pathway to support the sustainable adoption of RDF in cement manufacturing. Importantly, the future research directions are systematically derived from the core themes identified in the content analysis. Specifically, the conceptual ambiguity between RDF and SRF identified in Section 3.2.1 highlights the need for clearer classification frameworks and standardisation mechanisms. The regulatory fragmentation discussed in Section 3.2.2 underscores the need for harmonised policy frameworks and cross-jurisdictional alignment. Similarly, the sectoral positioning of RDF within CE and waste management frameworks (Section 3.2.3) reveals gaps in understanding

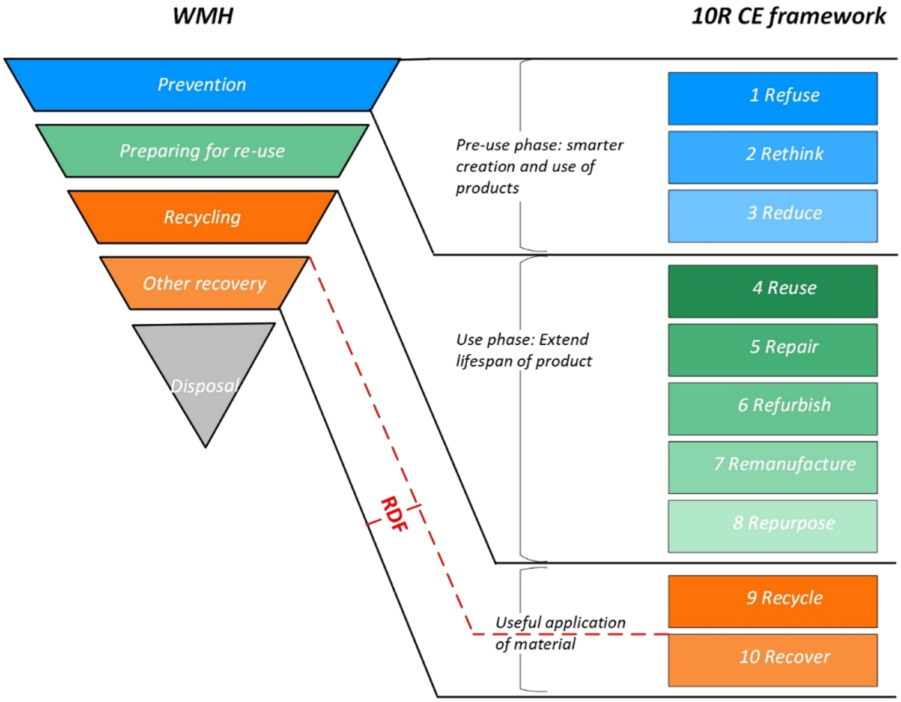

Figure 9. Position of RDF in WMH and the CE framework. Source:10 R- (Potting *et al.*, 2017b); WMH- (European Parliament and Council, 2008). Source: Authors' own work

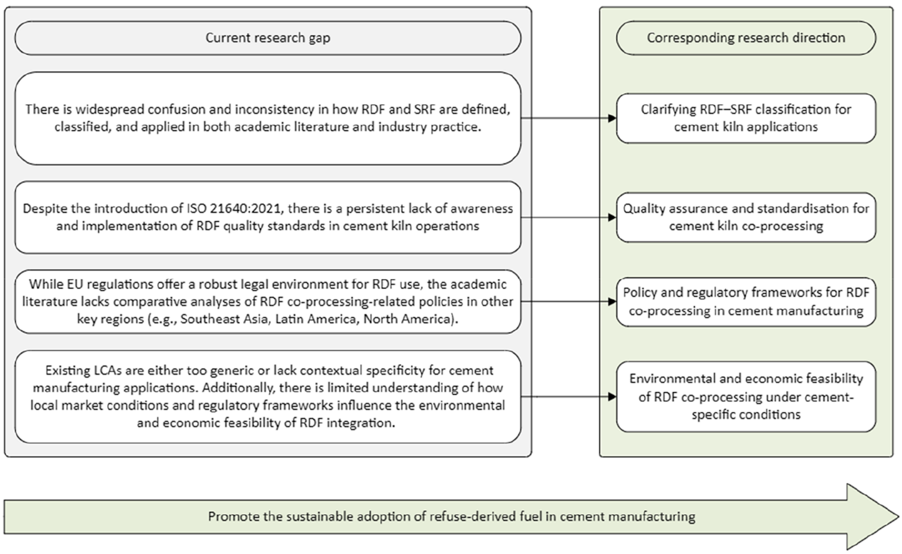

Figure 10. Future research directions for the sustainable adoption of RDF in cement manufacturing. Source: Authors' own work

how RDF contributes to broader sustainability transitions, thereby motivating further research into its role in integrated resource recovery systems.

Although these themes have broader relevance, they are interpreted in this study within the specific operational, environmental and policy context of cement-kiln co-processing. Accordingly, the diagram comprises two core components: (1) identified research gaps emerging directly from the findings and (2) corresponding research directions that address these gaps. This structured mapping ensures a clear and transparent connection between the evidence generated through the SLR and the proposed future research agenda.

4.1 Clarifying RDF–SRF classification for cement kiln applications

The literature highlights persistent confusion between RDF and SRF, which complicates regulatory compliance and contributes to inconsistencies in fuel quality and operational performance (Chavando *et al.*, 2022; De Gisi *et al.*, 2018). In cement manufacturing, this ambiguity is not merely conceptual: it has direct implications for kiln feed acceptance, emissions assurance, procurement contracts and communication between RDF producers and cement manufacturers. While this review addresses the theoretical distinctions between the two, there remains a need for greater practical clarity to support industry understanding and application. Enhancing awareness among practitioners can promote accurate classification, improve regulatory alignment and guide informed procurement decisions for cement plants. Ultimately, this would contribute to the development of a harmonised terminology and quality standards, fostering stakeholder confidence and enabling more effective policy implementation and market integration within the cement sector.

4.2 Quality assurance and standardisation for cement kiln co-processing

The ongoing variability in the compositional quality of RDF/SRF, particularly in terms of calorific value, chlorine content and mercury content, remains a significant barrier to their broader adoption in cement manufacturing. While the introduction of ISO 21640:2021 has been recognised as an essential step toward building trust and consistency in the fuel market (Central Public Health and Environmental Engineering Organisation, 2018), its practical implementation is still limited. There is a notable lack of documented awareness and application of this standard in the current peer-reviewed academic literature. The efficient operation of a cement kiln and the quality of the final cement product are highly dependent on the use of fuels that meet strict compositional requirements (Genon and Brizio, 2008). This underscores the critical importance of ensuring that only RDF/SRF of appropriate quality is used as kiln feedstock. Given these challenges, future research should prioritise the investigation of effective implementation models for ISO standardisation across diverse regional contexts. In addition, there is a pressing need to develop robust quality control protocols that can ensure consistent compliance with these standards throughout the entire supply chain. Such efforts will be essential for supporting the reliable and sustainable integration of RDF/SRF in cement manufacturing.

4.3 Policy and regulatory frameworks for RDF co-processing in cement manufacturing

In the EU regulations, RDF is governed by a comprehensive suite of waste management directives that shape operational requirements for industrial users, including cement plants. These regulations help define the conditions under which RDF can be transported, classified, stored and combusted in cement kilns. While the EU's regulatory approach to RDF is well documented and widely adopted among member states, there remains a notable lack of detailed peer-reviewed analysis regarding the specific policy and regulatory frameworks governing RDF in other regions. Countries such as Indonesia, the USA and Brazil do have national regulations that address RDF to varying extents (de Lorena Diniz Chaves *et al.*, 2021; Mateus *et al.*, 2023; Shehata *et al.*, 2022), but the academic literature rarely provides in-depth comparative discussion of how these frameworks affect cement-sector uptake.

As highlighted in Table 2 of this review, key EU regulations generally refer to RDF in broad terms, without always making an explicit distinction between RDF and SRF. This is understandable, as SRF is produced from RDF and therefore falls under the broader regulatory umbrella. Within this context, ISO 21640:2021 stands out as the main international standard that formally differentiates SRF from RDF. Future research should therefore undertake comparative investigations of the regulatory frameworks governing RDF and SRF across different countries and regions, with explicit attention to the permitting, emissions and supply-chain implications for cement manufacturing. Such studies can generate context-specific insights for policymakers and support the design of regulatory settings that facilitate responsible cement-kiln adoption.

4.4 Environmental and economic feasibility of RDF co-processing under cement-specific conditions

A thorough evaluation of the environmental and economic impacts associated with the use of RDF/SRF is essential for advancing sustainable decision-making in the cement manufacturing industry. Although lifecycle assessment studies have provided initial insights into the environmental advantages and potential trade-offs of substituting conventional fossil fuels with RDF or SRF (Anasstasia *et al.*, 2020; Grzesik and Malinowski, 2016), there remains a notable gap in analyses that are specifically tailored to the context of cement manufacturing. Such work is essential for capturing the full spectrum of environmental implications and for understanding how local policy frameworks and market dynamics influence the feasibility and attractiveness of RDF/SRF adoption in the cement manufacturing sector.

5. Implications of the study

5.1 Research implications

This study contributes to the RDF literature by providing a sector-specific synthesis of RDF utilisation within cement manufacturing. A key contribution of the study is the clarification of the conceptual relationship between RDF and its standardised subset, SRF and the positioning of these within the context of cement kiln co-processing, CE and the WMH. In doing so, it addresses conceptual ambiguity identified in the literature and responds to the need for integrated, sector-specific analyses. Consistent with Makadok *et al.* (2018), the study contributes theoretically by refining key constructs, structuring fragmented knowledge and identifying new research questions that extend the scope of existing RDF discourse. The study also identifies several important research gaps that warrant further investigation. The findings suggest a need for greater standardisation of RDF classification systems and fuel quality assessment approaches, particularly across different regulatory contexts. Existing variations in national standards and operational requirements continue to hinder direct comparisons between studies and limit broader implementation. Furthermore, while environmental benefits associated with RDF utilisation are widely reported, additional research is required to evaluate long-term environmental, economic and social sustainability outcomes under different geographical and industrial conditions. Comparative studies examining RDF utilisation across multiple sectors and regions may further strengthen understanding of best practices and implementation pathways. Finally, the study develops a structured future research agenda derived directly from the identified knowledge gaps. By systematically linking conceptual ambiguities, regulatory fragmentation and sustainability challenges with future research priorities, the study provides a foundation for advancing both theoretical and empirical knowledge relating to RDF utilisation in cement manufacturing.

5.2 Industry and policy implications

The findings of this study provide several practical implications for industry stakeholders involved in RDF production, utilisation and regulation. Cement manufacturers can use the findings of the study to better align RDF/SRF selection with kiln operational requirements, emissions compliance and fuel quality standards, thereby reducing operational risks associated with inconsistent fuel characteristics. As highlighted by Genon and Brizio (2008), maintaining appropriate fuel quality characteristics is important for minimising operational disruptions and ensuring stable kiln performance. Similarly, improving RDF/SRF standardisation and quality assurance practices may enhance supply-chain reliability and stakeholder confidence, particularly in relation to calorific consistency and contaminant control (Central Public Health and Environmental Engineering Organisation, 2018; Kahawalage *et al.*, 2023).

For policymakers and regulatory agencies, the review highlights the importance of coherent and regionally adapted regulatory frameworks to support RDF co-processing in cement manufacturing. By identifying gaps in policy alignment and regulatory consistency, the findings provide a basis for designing policies that facilitate safe, efficient and scalable RDF utilisation, contributing to both waste diversion and industrial decarbonisation objectives.

From a broader sustainability perspective, the findings reinforce the potential role of RDF co-processing in supporting CE objectives by reducing reliance on landfill and substituting for fossil fuel consumption in cement manufacturing systems. As discussed by Ghisellini and Ulgiati (2020), CE approaches contribute to improved resource efficiency and more sustainable industrial systems. Therefore, wider adoption of RDF co-processing may contribute to both environmental sustainability and long-term industrial transition goals.

6. Conclusion

This study synthesised the current state of knowledge on the use of RDF in cement manufacturing, with a particular focus on its future research avenues. An SLR of 211 scholarly articles published between 1991 and July 2025 was subjected to descriptive analysis, and 48 records, including seven regulatory records, were employed for the content analysis. The results indicate that scholarly interest in RDF as a sustainable fuel alternative has increased significantly over the past decade, with more than 80% of publications emerging since 2014. This trend reflects a heightened global emphasis on reducing carbon emissions from hard-to-abate industries, such as cement manufacturing.

The analysis also reveals persistent confusion in the literature between the terms “RDF” and “SRF”, as many studies use these terms interchangeably. This lack of terminological clarity poses challenges for quality control and regulatory compliance, particularly at the national level. In terms of functional role, RDF is found to be an important enabler in both the sustainable waste management and CE frameworks. Positioned in the “other recovery” tier of the WMH and corresponding to the “recover” strategy in the 10 R CE framework, RDF provides a critical solution for managing non-recyclable, combustible waste fractions.

Further, several limitations should also be acknowledged. First, the exclusive reliance on the WoS database may have limited the potential to overlook relevant studies from other databases. Thus, future studies should including other major academic databases such as Scopus, PubMed, Google Scholar and specialised or regional databases. This widens the coverage and increases the likelihood of capturing relevant studies that may not be indexed in WoS. Second, the analysis was limited to English-language publications, which could have excluded critical regional studies, particularly from non-English-speaking countries. Future work should consider including non-English literature to enrich the understanding, especially regarding region-specific practices and innovations. Third, the study deliberately focused on the cement manufacturing sector to enable an in-depth, sector-specific analysis. This targeted approach enabled a detailed examination of technical, environmental and policy factors unique to cement co-processing. However, it inherently excludes potentially transferable insights from other industries that utilise RDF, such as WtE plants or district heating networks. While this focus ensures depth and contextual relevance, future comparative analyses across sectors could yield broader generalisability and policy-relevant insights. Overall, this study contributes to a foundational understanding of RDF uptake in cement co-processing, positioning it as both an environmental and resource-efficiency solution aligned with global sustainability objectives.

Supplementary material

The supplementary material for this article can be found online.

References

Ali, A., Mahfouz, A. and Arisha, A. (2017), "Analysing supply chain resilience: integrating the constructs in a concept mapping framework via a systematic literature review", *Supply Chain Management*, Vol. 22 No. 1, pp. 16-39, doi: 10.1108/SCM-06-2016-0197.

Amiri, A. and Vaseghi, M.R. (2015), "Waste heat recovery power generation systems for cement production process", *IEEE Transactions on Industry Applications*, Vol. 51 No. 1, pp. 13-19, doi: 10.1109/TIA.2014.2347196.

Anasstasia, T.T., Lestianingrum, E., Cahyono, R.B. and Azis, M.M. (2020), "Life cycle assessment of refuse derived fuel (RDF) for municipal solid waste (MSW) management: case study area around cement industry, cirebon, Indonesia", *IOP Conference Series: Materials Science and Engineering*, Vol. 778 No. 1, 012146, doi: 10.1088/1757-899X/778/1/012146.

Andrew, R.M. (2018), "Global CO2 emissions from cement production", *Earth System Science Data*, Vol. 10 No. 1, pp. 195-217, doi: 10.5194/essd-10-195-2018.

Andrew, R.M. (2019), "Global CO2 emissions from cement production, 1928-2018", *Earth System Science Data*, Vol. 11 No. 4, pp. 1675-1710, doi: 10.5194/essd-11-1675-2019.

Atmaca, A. and Atmaca, N. (2022), "Carbon footprint assessment of residential buildings, a review and a case study in Turkey", *Journal of Cleaner Production*, Vol. 340, 130691, doi: 10.1016/j.jclepro.2022.130691.

Azarian, M., Yu, H., Shiferaw, A.T. and Stevik, T.K. (2023), "Do we perform systematic literature review right? A scientific mapping and methodological assessment", *Logistics*, Vol. 7 No. 4, p. 89, doi: 10.3390/logistics7040089.

Belbute, J.M. and Pereira, A.M. (2020), "Reference forecasts for CO2 emissions from fossil-fuel combustion and cement production in Portugal", *Energy Policy*, Vol. 144, 111642, doi: 10.1016/j.enpol.2020.111642.

Bendjedia, B., Rizoug, N., Boukhnifer, M., Bouchafaa, F. and Benbouzid, M. (2018), "Influence of secondary source technologies and energy management strategies on energy storage system sizing for fuel cell electric vehicles", *International Journal of Hydrogen Energy*, Vol. 43 No. 25, pp. 11614-11628, doi: 10.1016/j.ijhydene.2017.03.166.

Benhelal, E., Zahedi, G., Shamsaei, E. and Bahadori, A. (2013), "Global strategies and potentials to curb CO2 emissions in cement industry", *Journal of Cleaner Production*, Vol. 51, pp. 142-161, doi: 10.1016/j.jclepro.2012.10.049.

Benzies, K.M., Premji, S., Hayden, K.A. and Serrett, K. (2006), "State-of-the-evidence reviews: advantages and challenges of including grey literature", *Worldviews on Evidence-Based Nursing*, Vol. 3 No. 2, pp. 55-61, doi: 10.1111/j.1741-6787.2006.00051.x.

Berardi, P., Almeida, M.F., Lopes, M.de.L. and Maia Dias, J. (2020), "Analysis of Portugal's refuse derived fuel strategy, with particular focus on the northern region", *Journal of Cleaner Production*, Vol. 277, 123262, doi: 10.1016/j.jclepro.2020.123262.

Bień, J. (2021), "Production and use of waste-derived fuels in Poland: current status and perspectives", *Production Engineering Archives*, Vol. 27 No. 1, pp. 36-41, doi: 10.30657/pea.2021.27.5.

Bosoaga, A., Masek, O. and Oakey, J.E. (2009), "CO2 capture technologies for cement industry", *Energy Procedia*, Vol. 1 No. 1, pp. 133-140, doi: 10.1016/j.egypro.2009.01.020.

Central Public Health and Environmental Engineering Organisation (2018), "Guidelines on usage of refuse derived fuel in various industries expert committee constituted by ministry of housing and urban Affairs (MoHUA)",

Chandrasekhar, K. and Pandey, S. (2020), "Co-Processing of RDF in cement plants", in *Energy Recovery Processes from Wastes*, Springer Singapore, Singapore, pp. 225-236. doi: 10.1007/978-981-32-9228-4_19.

Chavando, J.A.M., Silva, V.B., Tarelho, L.A.C., Cardoso, J.S. and Eusébio, D. (2022), "Snapshot review of refuse-derived fuels", *Utilities Policy*, Vol. 74, 101316, doi: 10.1016/j.jup.2021.101316.

Çimen, Ö. (2021), "Construction and built environment in circular economy: a comprehensive literature review", *Journal of Cleaner Production*, Vol. 305, 127180, doi: 10.1016/j.jclepro.2021.127180.

Cole, C., Gnanapragasam, A., Cooper, T. and Singh, J. (2019), "An assessment of achievements of the WEEE Directive in promoting movement up the waste hierarchy: experiences in the UK", *Waste Management*, Vol. 87, pp. 417-427, doi: 10.1016/j.wasman.2019.01.046.

Davey, J., Turner, R.M., Clarke, M.J. and Higgins, J.P. (2011), "Characteristics of meta-analyses and their component studies in the Cochrane database of systematic reviews: a cross-sectional, descriptive analysis", *BMC Medical Research Methodology*, Vol. 11 No. 1, p. 160, doi: 10.1186/1471-2288-11-160.

De Gisi, S., Chiarelli, A., Tagliente, L. and Notarnicola, M. (2018), "Energy, environmental and operation aspects of a SRF-fired fluidized bed waste-to-energy plant", *Waste Management*, Vol. 73, pp. 271-286, doi: 10.1016/j.wasman.2017.04.044.

de Lorena Diniz Chaves, G., Siman, R.R., Ribeiro, G.M. and Chang, N.B. (2021), "Synergizing environmental, social, and economic sustainability factors for refuse derived fuel use in cement industry: a case study in Espirito Santo, Brazil", *Journal of Environmental Management*, Vol. 288, 112401, doi: 10.1016/j.jenvman.2021.112401.

Deja, J., Uliasz-Bochenczyk, A. and Mokrzycki, E. (2010), "CO2 emissions from polish cement industry", *International Journal of Greenhouse Gas Control*, Vol. 4 No. 4, pp. 583-588, doi: 10.1016/j.ijggc.2010.02.002.

Del Zotto, L., Tallini, A., Di Simone, G., Molinari, G. and Cedola, L. (2015), "Energy enhancement of solid recovered fuel within systems of conventional thermal power generation", *Energy Procedia*, Vol. 81, pp. 319-338, doi: 10.1016/j.egypro.2015.12.102.

Denyer, D. and Tranfield, D. (2009), "Producing a systematic review", in *The SAGE Handbook of Organizational Research Methods*, Sage Publications, pp. 671-689.

Department for Environment Food and Rrual Affairs (2011), "Guidance on applying the waste hierarchy",

Dey, A., Dhumal, C.V., Sengupta, P., Kumar, A., Pramanik, N.K. and Alam, T. (2021), "Challenges and possible solutions to mitigate the problems of single-use plastics used for packaging food items: a review", *Journal of Food Science and Technology*, Vol. 58 No. 9, pp. 3251-3269, doi: 10.1007/s13197-020-04885-6.

El jaouhari, A., Samadhiya, A., Kumar, A. and Luthra, S. (2025), "Integrating generative artificial intelligence into green logistics: a systematic review and policy-oriented research agenda", *Journal of Cleaner Production*, Vol. 519, 146018, doi: 10.1016/j.jclepro.2025.146018.

Erdiaw-Kwasie, M.O., Abunyewah, M. and Baah, C. (2024), "A systematic review of the factors – barriers, drivers, and technologies – affecting e-waste urban mining: on the circular economy future of developing countries", *Journal of Cleaner Production*, Vol. 436, 140645, doi: 10.1016/j.jclepro.2024.140645.

European Council (2013), "Directive 2008/98/EC", *Official Journal of the European Union*, Vol. 56 C 378, pp. 1-44.

European Investment Bank (2024), "Managing refuse-derived and solid recovered fuels", European Parliament and Council (2008), “Directive 2008/98/EC”, *Official Journal of the European Union*, Vol. 56 C 378, pp. 1-44.

European Union (1999), “Council Directive 1999/31/EC on the landfill”, *Official Journal of the European Communities*, Vol. 10, p. L182/1-19, doi: 10.1039/ap9842100196.

European Union (2006), “Regulation (EC) No 1013/2006 of the European Parliament and the Council of 14 June 2006 on shipments of waste”, *Official Journal of the European Union*, Vol. L190, pp. 1-98, available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32006R1013&from=EN.

European Union (2010), “Directive 2010/75/EU Industrial Emissions”, *Official Journal of the European Union*, Vol. L334 eng, pp. 17-119, doi: 10.3000/17252555.L_2010.334.

European Union (2018), “Directive (EU) 2018/2001 of the European Parliament and of the Council on the promotion of the use of energy from renewable sources”, *Official Journal of the European Union*, Vol. 2018 L 328, pp. 82-209, available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L2001.

European Union (2025), “Packaging and packaging waste, amending Regulation (EU) 2019/1020 and Directive (EU) 2019/904, and repealing Directive 94/62/EC”, *Official Journal of the European Union*, Vol. 40 No. 5, available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L_202500040

Evans, N., Bausewein, C., Meñaca, A., Andrew, E.V.W., Higginson, I.J., Harding, R., Pool, R. and Gysels, M. (2012), “A critical review of advance directives in Germany: attitudes, use and healthcare professionals’ compliance”, *Patient Education and Counseling*, Vol. 87 No. 3, pp. 277-288, doi: 10.1016/j.pec.2011.10.004.

Ewijk, S. and Stegemann, J.A. (2016), “Limitations of the waste hierarchy for achieving absolute reductions in material throughput”, *Journal of Cleaner Production*, Vol. 132, pp. 122-128, doi: 10.1016/j.jclepro.2014.11.051.

Farfan, J., Fasihi, M. and Breyer, C. (2019), “Trends in the global cement industry and opportunities for long-term sustainable CCU potential for Power-to-X”, *Journal of Cleaner Production*, Vol. 217, pp. 821-835, doi: 10.1016/j.jclepro.2019.01.226.

Ferdan, T., Pavlas, M., Nevrlý, V., Šomplák, R. and Stehlík, P. (2018), “Greenhouse gas emissions from thermal treatment of non-recyclable municipal waste”, *Frontiers of Chemical Science and Engineering*, Vol. 12 No. 4, pp. 815-831, doi: 10.1007/s11705-018-1761-4.

Forman, C., Muritala, I.K., Pardemann, R. and Meyer, B. (2016), “Estimating the global waste heat potential”, *Renewable and Sustainable Energy Reviews*, Vol. 57, pp. 1568-1579, doi: 10.1016/j.rser.2015.12.192.

Fumo, N. and Chamra, L.M. (2010), “Analysis of combined cooling, heating, and power systems based on source primary energy consumption”, *Applied Energy*, Vol. 87 No. 6, pp. 2023-2030, doi: 10.1016/j.apenergy.2009.11.014.

Gałko, G., Mazur, I., Rejdak, M., Jagustyn, B., Hrabak, J., Ouadi, M., Jahangiri, H. and Sajdak, M. (2023), “Evaluation of alternative refuse-derived fuel use as a valuable resource in various valorised applications”, *Energy*, Vol. 263, 125920, doi: 10.1016/j.energy.2022.125920.

Gao, T., Shen, L., Shen, M., Chen, F., Liu, L. and Gao, L. (2015), “Analysis on differences of carbon dioxide emission from cement production and their major determinants”, *Journal of Cleaner Production*, Vol. 103, pp. 160-170, doi: 10.1016/j.jclepro.2014.11.026.

Garg, A., Smith, R., Hill, D., Simms, N. and Pollard, S. (2007), “Wastes as co-fuels: the policy framework for solid recovered fuel (SRF) in Europe, with UK implications”, *Environmental Science and Technology*, Vol. 41 No. 14, pp. 4868-4874, doi: 10.1021/es062163e.

Genon, G. and Brizio, E. (2008), “Perspectives and limits for cement kilns as a destination for RDF”, *Waste Management*, Vol. 28 No. 11, pp. 2375-2385, doi: 10.1016/j.wasman.2007.10.022.

Genovese, A., Acquaye, A.A., Figueroa, A. and Koh, S.C.L. (2017), “Sustainable supply chain management and the transition towards a circular economy: evidence and some applications”, *Omega*, Vol. 66, pp. 344-357, doi: 10.1016/j.omega.2015.05.015.

Ghisellini, P. and Ulgiati, S. (2020), "Circular economy transition in Italy. Achievements, perspectives and constraints", *Journal of Cleaner Production*, Vol. 243, 118360, doi: 10.1016/j.jclepro.2019.118360.

Grames, E.M., Stillman, A.N., Tingley, M.W. and Elphick, C.S. (2019), "An automated approach to identifying search terms for systematic reviews using keyword co-occurrence networks", *Methods in Ecology and Evolution*, Vol. 10 No. 10, pp. 1645-1654, doi: 10.1111/2041-210X.13268.

Grant, M.J. and Booth, A. (2009), "A typology of reviews: an analysis of 14 review types and associated methodologies", *Health Information and Libraries Journal*, Vol. 26 No. 2, pp. 91-108, doi: 10.1111/j.1471-1842.2009.00848.x.

Grzesik, K. and Malinowski, M. (2016), "Life cycle assessment of refuse-derived fuel production from mixed municipal waste", *Energy Sources, Part A: Recovery, Utilization, and Environmental Effects*, Vol. 38 No. 21, pp. 3150-3157, doi: 10.1080/15567036.2015.1136976.

Güereca, L.P., Torres, N. and Juárez-López, C.R. (2015), "The co-processing of municipal waste in a cement kiln in Mexico. A life-cycle assessment approach", *Journal of Cleaner Production*, Vol. 107, pp. 741-748, doi: 10.1016/j.jclepro.2015.05.085.

Hemidat, S., Saidan, M., Al-Zu'bi, S., Irshidat, M., Nassour, A. and Nelles, M. (2019), "Potential utilization of RDF as an alternative fuel to be used in cement industry in Jordan", *Sustainability*, Vol. 11 No. 20, p. 5819, doi: 10.3390/su11205819.

Imbabi, M.S., Carrigan, C. and McKenna, S. (2012), "Trends and developments in green cement and concrete technology", *International Journal of Sustainable Built Environment*, Vol. 1 No. 2, pp. 194-216, doi: 10.1016/j.ijsbe.2013.05.001.

Johansson, N. and Henriksson, M. (2020), "Circular economy running in circles? A discourse analysis of shifts in ideas of circularity in Swedish environmental policy", *Sustainable Production and Consumption*, Vol. 23, pp. 148-156, doi: 10.1016/j.spc.2020.05.005.

Jones, P. and Hudson, J. (1996), "Standardization and the costs of assessing quality", *European Journal of Political Economy*, Vol. 12 No. 2, pp. 355-361, doi: 10.1016/0176-2680(95)00021-6.

Kabirifar, K., Mojtahedi, M., Wang, C. and Tam, V.W.Y. (2020), "Construction and demolition waste management contributing factors coupled with reduce, reuse, and recycle strategies for effective waste management: a review", *Journal of Cleaner Production*, Vol. 263, 121265, doi: 10.1016/j.jclepro.2020.121265.

Kahawalage, A.C., Melaaen, M.C. and Tokheim, L.A. (2023), "Opportunities and challenges of using SRF as an alternative fuel in the cement industry", *Cleaner Waste Systems*, Vol. 4, 100072, doi: 10.1016/j.clwas.2022.100072.

Kahoush, M. and Kadi, N. (2022), "Towards sustainable textile sector: fractionation and separation of cotton/polyester fibers from blended textile waste", *Sustainable Materials and Technologies*, Vol. 34, e00513, doi: 10.1016/j.susmat.2022.e00513.

Kaur, A., Bharti, R. and Sharma, R. (2021), "Municipal solid waste as a source of energy", *Materials Today: Proceedings*, Vol. 81 No. 2, pp. 904-915, doi: 10.1016/j.matpr.2021.04.286.

Khaw, T.Y., Amran, A. and Teoh, A.P. (2024), "Factors influencing ESG performance: a bibliometric analysis, systematic literature review, and future research directions", *Journal of Cleaner Production*, Vol. 448, 141430, doi: 10.1016/j.jclepro.2024.141430.

Li, K., Rollins, J. and Yan, E. (2018), "Web of Science use in published research and review papers 1997-2017: a selective, dynamic, cross-domain, content-based analysis", *Scientometrics*, Vol. 115 No. 1, pp. 1-20, doi: 10.1007/s11192-017-2622-5.

Lombardi, L., Carnevale, E. and Corti, A. (2015), "A review of technologies and performances of thermal treatment systems for energy recovery from waste", *Waste Management*, Vol. 37, pp. 26-44, doi: 10.1016/j.wasman.2014.11.010.

Long, H., Liao, Y., Cui, C., Liu, M., Liu, Z., Li, L., Hu, W. and Yan, D. (2022), "Assessment of popular techniques for co-processing municipal solid waste in Chinese cement kilns", *Frontiers of Environmental Science and Engineering*, Vol. 16 No. 4, p. 51, doi: 10.1007/s11783-021-1485-4.

Loo, S.L., Yu, E. and Hu, X. (2023), "Tackling critical challenges in textile circularity: a review on strategies for recycling cellulose and polyester from blended fabrics", *Journal of Environmental Chemical Engineering*, Vol. 11 No. 5, 110482, doi: 10.1016/j.jece.2023.110482.

Mahood, Q., Van Eerd, D. and Irvin, E. (2014), "Searching for grey literature for systematic reviews: challenges and benefits", *Research Synthesis Methods*, Vol. 5 No. 3, pp. 221-234, doi: 10.1002/jrsm.1106.

Makadok, R., Burton, R. and Barney, J. (2018), "A practical guide for making theory contributions in strategic management", *Strategic Management Journal*, Vol. 39 No. 6, pp. 1530-1545, doi: 10.1002/smj.2789.

Mancheri, N.A., Sprecher, B., Deetman, S., Young, S.B., Bleischwitz, R., Dong, L., Kleijn, R. and Tukker, A. (2018), "Resilience in the tantalum supply chain", *Resources, Conservation and Recycling*, Vol. 129, pp. 56-69, doi: 10.1016/j.resconrec.2017.10.018.

Mateus, M.M., Cecílio, D., Fernandes, M.C. and Neiva Correia, M.J. (2023), "Refuse derived fuels as an immediate strategy for the energy transition, circular economy, and sustainability", *Business Strategy and the Environment*, Vol. 32 No. 6, pp. 3915-3926, doi: 10.1002/bse.3345.

Moher, D., Liberati, A., Tetzlaff, J., Altman, D.G., Altman, D., Antes, G. and Atkins, D. (2009), "Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement (Chinese edition)", *Journal of Chinese Integrative Medicine*, Vol. 7 No. 9, pp. 889-896, doi: 10.3736/jcim20090918.

Moumin, G., Ryssel, M., Zhao, L., Markewitz, P., Sattler, C., Robinius, M. and Stolten, D. (2020), "CO2 emission reduction in the cement industry by using a solar calciner", *Renewable Energy*, Vol. 145, pp. 1578-1596, doi: 10.1016/j.renene.2019.07.045.

Neves, S.A. and Marques, A.C. (2022), "Drivers and barriers in the transition from a linear economy to a circular economy", *Journal of Cleaner Production*, Vol. 341, 130865, doi: 10.1016/j.jclepro.2022.130865.

O'Connor, M., Sutton, A. and Hennessy, E. (2024), "The components and characteristics of safety management plans used to reduce the risk of self harm: a PRISMA scoping review", *Archives of Suicide Research*, Vol. 29 No. 2, pp. 1-14, doi: 10.1080/13811118.2024.2363226.

Paramita, W., Hartono, D.M. and Soesilo, T.E.B. (2018), "Sustainability of refuse derived fuel potential from municipal solid waste for cement's alternative fuel in Indonesia (A case at Jeruklegi landfill, in Cilacap)", *IOP Conference Series: Earth and Environmental Science*, Vol. 159 No. 1, 012027, doi: 10.1088/1755-1315/159/1/012027.

Patel, M.L. and Chauhan, J.S. (2014), "Municipal solid waste: alternative source of energy to the cement kilns in the state of Madhya Pradesh, India", *International Journal of Environment and Sustainable Development*, Vol. 13 No. 2, pp. 142-152, doi: 10.1504/IJESD.2014.060194.

Poerner, M. and Rimpel, A. (2017), "Waste heat recovery", *Fundamentals and Applications of Supercritical Carbon Dioxide (SCO2) Based Power Cycles*, pp. 255-267, doi: 10.1016/B978-0-08-100804-1.00010-4.

Potting, J., Hekkert, M., Worrell, E. and Hanemaaijer, A. (2017), "Circular Economy: measuring innovation in the product chain - policy report", PBL Netherlands Environmental Assessment Agency, No. January, pp. 1-46.

Psaltis, P. and Komilis, D. (2019), "Environmental and economic assessment of the use of biodrying before thermal treatment of municipal solid waste", *Waste Management*, Vol. 83, pp. 95-103, doi: 10.1016/j.wasman.2018.11.007.

Romero-Hernández, O. and Romero, S. (2018), "Maximizing the value of waste: from waste management to the circular economy", *Thunderbird International Business Review*, Vol. 60 No. 5, pp. 757-764, doi: 10.1002/tie.21968.

Sakri, A., Aouabed, A., Nassour, A. and Nelles, M. (2021), "Refuse-derived fuel potential production for co-combustion in the cement industry in Algeria", *Waste Management and Research*, Vol. 39 No. 9, pp. 1174-1184, doi: 10.1177/0734242X20982277.

Santos, S.M., Nobre, C., Brito, P. and Gonçalves, M. (2023), "Brief overview of refuse-derived fuel production and energetic valorization: applied technology and main challenges", *Sustainability*, Vol. 15 No. 13, p. 10342, doi: 10.3390/su151310342.

Sarquah, K., Narra, S., Beck, G., Awafo, E.A. and Antwi, E. (2022a), "Bibliometric analysis; characteristics and trends of refuse derived fuel research", *Sustainability*, Vol. 14 No. 4, p. 1994, doi: 10.3390/su14041994.

Sarquah, K., Narra, S., Beck, G., Bassey, U., Antwi, E., Hartmann, M., Derkyi, N.S.A., Awafo, E.A. and Nelles, M. (2022b), "Characterization of municipal solid waste and assessment of its potential for refuse-derived fuel (RDF) valorization", *Energies*, Vol. 16 No. 1, p. 200, doi: 10.3390/en16010200.

Serrano, D., Sánchez-Delgado, S., Horvat, A., Marugán-Cruz, C., Batuecas, E., Kelebopile, L. and Kwapinska, M. (2024), "Non-recyclable municipal solid waste characterization and pyrolysis for energy recovery", *Bioresource Technology*, Vol. 415, 131641, doi: 10.1016/j.biortech.2024.131641.

Sharma, P., Sheth, P. and Mohapatra, B. (2022), "Recent progress in refuse derived fuel (RDF) Co-processing in cement production: direct firing in kiln/calciner vs process integration of RDF gasification", *Waste and Biomass Valorization*, Vol. 13 No. 11, pp. 4347-4374, doi: 10.1007/s12649-022-01840-8.

Shehata, N., Obaideen, K., Sayed, E.T., Abdelkareem, M.A., Mahmoud, M.S., El-Salamony, A.L.H.R., Mahmoud, H.M. and Olabi, A. (2022), "Role of refuse-derived fuel in circular economy and sustainable development goals", *Process Safety and Environmental Protection*, Vol. 163, pp. 558-573, doi: 10.1016/j.psep.2022.05.052.

Subramanian, K., Sarkar, M.K., Wang, H., Qin, Z.H., Chopra, S.S., Jin, M., Kumar, V., Chen, C., Tsang, C.W. and Lin, C.S.K. (2022), "An overview of cotton and polyester, and their blended waste textile valorisation to value-added products: a circular economy approach–research trends, opportunities and challenges", *Critical Reviews in Environmental Science and Technology*, Vol. 52 No. 21, pp. 3921-3942, doi: 10.1080/10643389.2021.1966254.

Tahir, J., Ahmad, R. and Martinez, P. (2024), "A critical review of sustianable refuse-derived fuel production in waste processing facility", *Energy Conversion and Management X*, Vol. 24, 100687, doi: 10.1016/j.ecmx.2024.100687.

Tennakoon, G., Rameezdeen, R. and Chileshe, N. (2022), "Diverting demolition waste toward secondary markets through integrated reverse logistics supply chains: a systematic literature review", *Waste Management and Research: The Journal for a Sustainable Circular Economy*, Vol. 40 No. 3, pp. 274-293, doi: 10.1177/0734242X211021478.

Tennakoon, G.A., Rameezdeen, R. and Chileshe, N. (2023), "Identifying factors affecting the low uptake of reprocessed construction materials: a systematic literature review", *Waste Management and Research: The Journal for a Sustainable Circular Economy*, Vol. 41 No. 4, pp. 781-800, doi: 10.1177/0734242X221135244.

Thisakya, G. and Dissanayake, P. (2026), "A socio-technical systems analysis of occupational health and safety hazards among municipal solid waste handlers: evidence from Sri Lankan urban municipalities", *Facilities*, pp. 1-21.

Tihin, G.L., Mo, K.H., Onn, C.C., Ong, H.C., Taufiq-Yap, Y.H. and Lee, H.V. (2023), "Overview of municipal solid wastes-derived refuse-derived fuels for cement co-processing", *Alexandria Engineering Journal*, Vol. 84, pp. 153-174, doi: 10.1016/j.aej.2023.10.043.

Townsend, T.G. and Anshassi, M. (2023), "Hazardous and dangerous materials in CDD", pp. 137-189, doi: 10.1007/978-3-031-25013-2_5.

Tranfield, D., Denyer, D. and Smart, P. (2003), "Towards a methodology for developing evidence-informed management knowledge by means of systematic review", *British Journal of Management*, Vol. 14 No. 3, pp. 207-222, doi: 10.1111/1467-8551.00375.

Uratani, J.M. and Griffiths, S. (2023), "A forward looking perspective on the cement and concrete industry: implications of growth and development in the Global South", *Energy Research and Social Science*, Vol. 97, 102972, doi: 10.1016/j.erss.2023.102972.

Vaismoradi, M., Turunen, H. and Bondas, T. (2013), "Content analysis and thematic analysis: implications for conducting a qualitative descriptive study", *Nursing and Health Sciences*, Vol. 15 No. 3, pp. 398-405, doi: 10.1111/nhs.12048.

Van Acker, J., Van den Bulcke, J., Forsthuber, B. and Grüll, G. (2023), "Wood preservation and wood finishing", pp. 793-871, doi: 10.1007/978-3-030-81315-4_15.

van Deventer, J.S.J., White, C.E. and Myers, R.J. (2021), "A roadmap for production of cement and concrete with low-CO2 emissions", *Waste and Biomass Valorization*, Vol. 12 No. 9, pp. 4745-4775, doi: 10.1007/s12649-020-01180-5.

Wojtacha-Rychter, K., Kucharski, P. and Smolinski, A. (2021), "Conventional and alternative sources of thermal energy in the production of cement—an impact on co2 emission", *Energies*, Vol. 14 No. 6, p. 1539, doi: 10.3390/en14061539.

Yildizbasi, A., Celik, S.E., Arioz, Y., Chen, Z., Sun, L. and Ozturk, C. (2025), "Exploring the synergy between circular economy and emerging technologies for transportation infrastructure: a systematic literature review", *Journal of Cleaner Production*, Vol. 486, 144553, doi: 10.1016/j.jclepro.2024.144553.

Zhu, J. and Liu, W. (2020), "A tale of two databases: the use of Web of Science and Scopus in academic papers", *Scientometrics*, Vol. 123 No. 1, pp. 321-335, doi: 10.1007/s11192-020-03387-8.

Further reading

Ali, M.B., Saidur, R. and Hossain, M.S. (2011), "A review on emission analysis in cement industries", *Renewable and Sustainable Energy Reviews*, Vol. 15 No. 5, pp. 2252-2261, doi: 10.1016/j.rser.2011.02.014.

Saidur, R., Atabani, A.E. and Mekhilef, S. (2011), "A review on electrical and thermal energy for industries", *Renewable and Sustainable Energy Reviews*, Vol. 15 No. 4, pp. 2073-2086, doi: 10.1016/j.rser.2011.01.008.

Summerbell, D.L., Barlow, C.Y. and Cullen, J.M. (2016), "Potential reduction of carbon emissions by performance improvement: a cement industry case study", *Journal of Cleaner Production*, Vol. 135, pp. 1327-1339, doi: 10.1016/j.jclepro.2016.06.155.

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