SCRREEN2

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FACTSHEETS UPDATES **BASED ON THE EU FACTSHEETS 2020**

DIATOMITE

AUTHOR(S):

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DIATOMITE

OVERVIEW

Diatomite is a powdery, siliceous, sedimentary rock. It is of very low density, extremely porous and chemically inert (Crangle, 2016). The exact characteristics of these properties are determined by the diatom forms in the diatomite. There are 15,000-20,000 different forms of diatoms known, due to the fact that they are created from thousands of different fossilized species. Synonyms of diatomite are tripolite and kieselguhr. Further, distinctions in quality and possible applications derive from the impurities in the raw material such as clay minerals, iron content, or fine-grained carbonates. With its outstanding filtration properties, and low thermal and acoustic conductivity, it is a very versatile raw material.

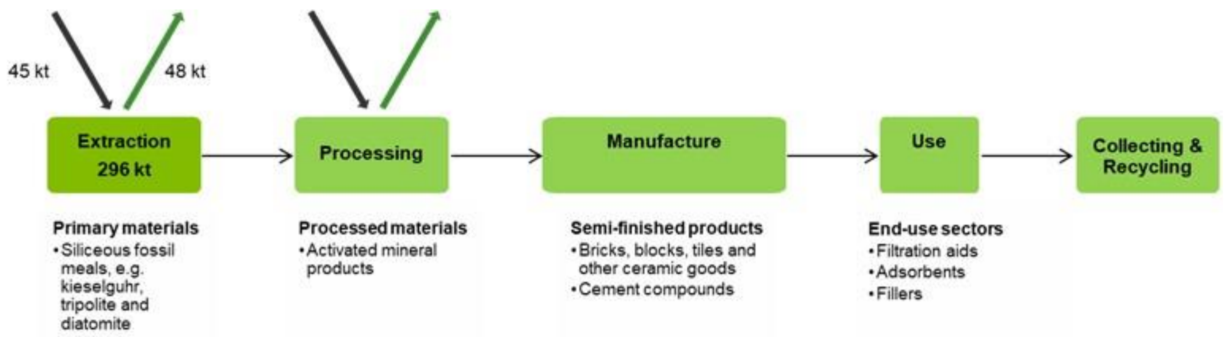

Figure 1. Simplified value chain for Diatomite in the EU[1]

Table 1. Diatomite supply and demand in metric tonnes, 2016-2020 average

Global production	Global Producers	EU consumption (EU Sourcing)	EU Share	EU Suppliers	Import reliance
2,207,194	USA 36% China 17% Turkey 7% Other 39%	354,691	16%	USA 54% Mexico 20% Russia 18% Other 9%	1%

Prices: The price changes of diatomite are driven by the industrial demand for filtration and microbial removal applications, for example, in beverage, cosmetics, and pharmaceutical industries (Adroit Market Research, 2021). Diatomite price volatility was around 14% between 2016 and 2020.

[1] JRC elaboration on multiple sources (see next sections)

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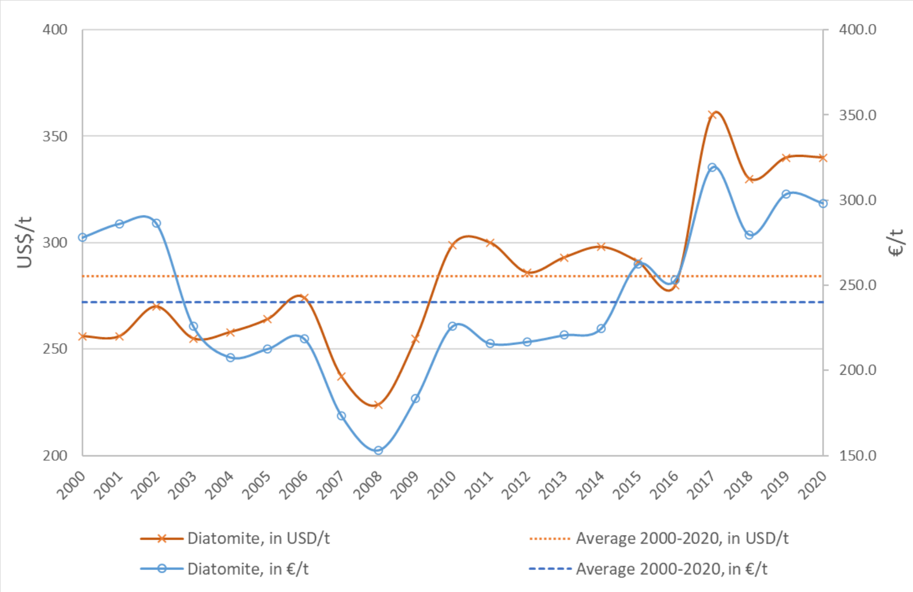

Figure 2. Annual average price of diatomite between 2000 and 2020 (USGS, 2021)[2].

Primary supply: Europe is a net exporter of diatomite, import reliance for this materials is therefore negative. Imports of diatomite to Europe from extra-EU countries are mainly from United States, Turkey, Mexico, Russian Federation, China, Armenia and UK. In Europe, Denmark in the largest producer (5% of global production) but France is also an important producer (4% of global production). Overall five countries are recorded as diatomite producers in Europe.

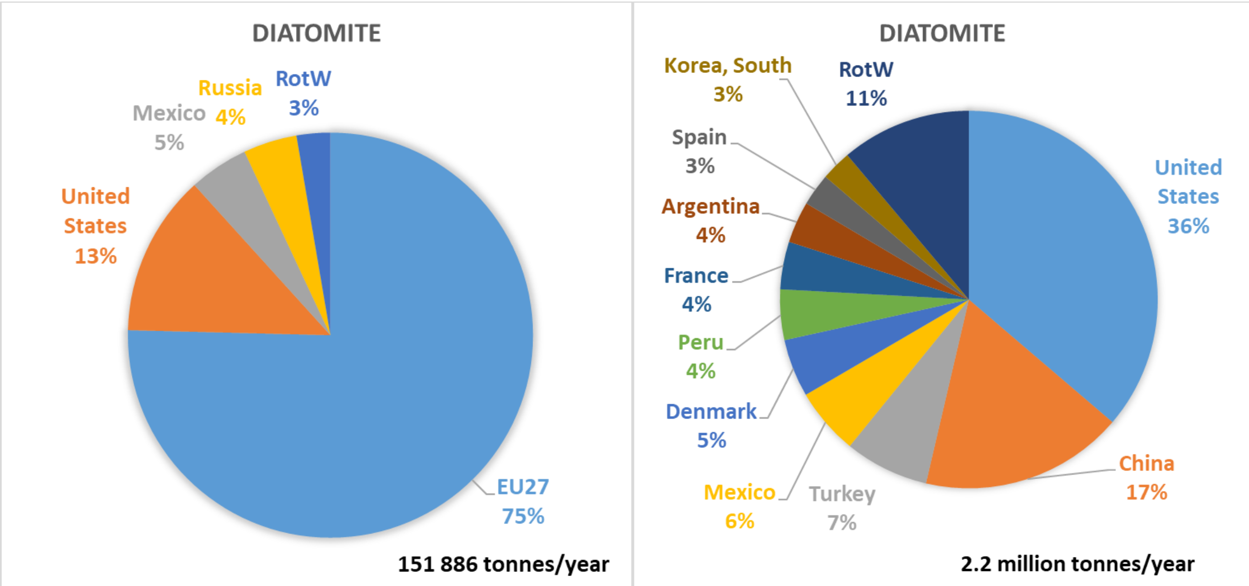

Figure 3. EU sourcing of diatomite and global mine production (update)

[2] Values in €/kg are converted from original data in US$/kg by using the annual average Euro foreign exchange reference rates from the European Central Bank (https://www.ecb.europa.eu/stats/policy_and_exchange_rates/euro_reference_exchange_rates/html/eurofxref-graph-usd.en.html)

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Secondary supply: Diatomite is barely recovered as such during waste management and therefore the contribution from secondary sources is rather limited. During experts consultations (SCRREEN workshops, 2019) it emerged that some forms of functional recycling from uses in civil engineering and foundry could be considered, which correspond to an overall EoL-RIR of 4%. Some recent (Chinese) patents have appeared for recycling of diatomite. Semi-industrial tests have shown that spent diatomite sludge by filtration systems can efficiently be used as an additive in ceramic bricks at amounts up to 9 wt.%, without creating a downgrading to their physicochemical and mechanical properties.

Uses: Diatomite has a wide range of applications. It is an excellent **filtration** medium / aid in the food industry, and it is commonly used in the filtration of beverages (beer, wine or juice), wastewater or paints. Diatomite can be used as **fillers/carriers** (food & beverage manufacturing and chemical industry) and as a filler in rubber or plastic. It is also an **absorbent,** with a high capacity for liquids, diatomite variants are used in gas purification processes as well as in the production of pet litter. Diatomite is further used in the clean-up of spills in different industries (IDPA, 2016). Calcined diatomite powder is also used in the production of explosives or seed coating. (Inglethorpe, 1993)

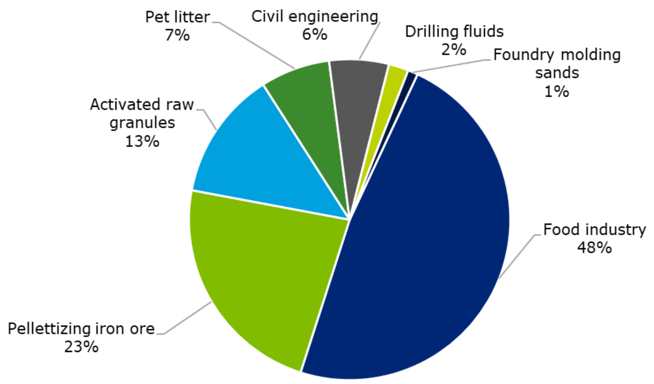

Figure 4: EU uses of Diatomite

Substitution: Although diatomite has unique properties it can be substituted in nearly all applications. Perlite or bentonite can be used in filtration. Cellulose or potato starch can be used for beverage filtration. Possible substitutes for filler applications are kaolin clay, Ground Calcium Carbonate (GCC), ground mica, perlite, talc, vermiculite and ground limestone.

Table 2. Uses and possible substitutes

Application	Share*	Substitutes	SubShare	Cost	Performance
Food industry	48%	Expanded perlite	13%	Slightly higher costs (up to 2 times)	Reduced
Food industry	48%	Silica sand	12.5%	Similar or lower costs	Reduced
Food industry	48%	Bentonite	12.5%		
Food industry	48%	Synthetic materials (ceramic/polymer/carbon membranes)	12.5%	Slightly higher costs (up to 2 times)	Similar
Pellettizing iron ore	23%	Bentonite	5%		

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Other issues: During diatomite processing, exposure to crystalline silica (principally cristobalite) can occur when not using the proper health and safety equipment (Checkoway et al. 1993; Industrials Minerals Europe 2011). Recent studies have shown that exposure to respirable crystalline silica dust (RCS) can have negative health effects and in some cases, when having a prolonged exposure can cause damage to the respiratory system and can increase the risk of mortality from lung cancer (Rice et al. 2001; Bunch, Bond, and Stone 2013). No environmental issues were found in the scientific literature review. In addition, no LCAs studies could be found related to any life cycle stage or specific use of the material during the scientific literature review. Globally the diatomite economy is very small (about 0.0001% of the total world trade market). The market is also very limited for the main producing countries (China 0.002%, USA 0.003%, Italy 0.007%, Spain 0.009%). In 2020, the bentonite export market represented about 0.1 of the total United Republic of Tanzania (COMTRADE, 2020).

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MARKET ANALYSIS, TRADE AND PRICES

GLOBAL MARKET

Table 3 Diatomite supply and demand at extraction stage in metric tonnes, 2016-2020 average

Global production	Global Producers	EU consumption (EU Sourcing)	EU Share	EU Suppliers	Import reliance
2,207,194	USA 36% China 17% Turkey 7% Other 39%	354,691	16%	USA 54% Mexico 20% Russia 18% Other 9%	1%

Indicators of supply concentration, stability of producer countries, substitutability, price volatility and world resources of diatomite imply that the global diatomite market is relatively stable.
The USA dominate the production side of the global diatomite market, which can be partly attributed to the large diatomite deposits and (low-cost) open-pit mining in the USA – other diatomite-producing countries often rely on underground mining for geological reasons (USGS, 2021). Country concentration of the global diatomite (mine) supply can be characterised as 'medium' (Barazi et al., 2021) with China and Turkey following the USA as major diatomite producers (see Table). The (weighted) country risk of the global diatomite (mine) supply, calculated on the basis of Worldwide Governance Indicators, is relatively low (Barazi et al., 2021).
The consumption side of the global diatomite market is dominated by the USA as well (USGS, 2021). The major driver of global diatomite consumption are the applications of diatomite in filtering, which range from purification of beer to filtering of blood (SCRREEN, 2021; USGS, 2021). Despite substitutability of diatomite by other materials in almost all of its applications, its unique properties assure its further usage; in particular, price is a key factor in the choice of diatomite (European Commission, 2020; SCRREEN, 2021; USGS, 2021).

Table 4. Relevant Eurostat CN trade codes for diatomite

Processing/refining	
CN trade code	**title**
2512 00 00	Siliceous fossil meals (for example, kieselguhr, tripolite and diatomite) and similar siliceous earths, whether or not calcined, of an apparent specific gravity of 1 or less
6901 00 00	Bricks, blocks, tiles and other ceramic goods of siliceous fossil meals (for example, kieselguhr, tripolite or diatomite) or of similar siliceous earths

Historically, price volatility of diatomite was relatively low (European Commission, 2020; SCRREEN, 2021). Global diatomite resources are 'adequate for the foreseeable future' (USGS, 2021). Actors at the firm level of the diatomite market are Calgon Carbon Corporation, EP Minerals, Imerys, Showa Chemical Industry Co. and others (IDPA 2019).

Despite the COVID-19 crisis, a (year-on-year) decrease in diatomite production in is not observable in 2020 as far as data is available (USGS, 2021).

For the purpose of this assessment, diatomite is evaluated at both extraction and processing stage.

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EU TRADE

Figure 5 shows the EU trade of diatomite (CN 2512 00 00) between 2000 and 2020. Over the whole period, the EU was a net importer of diatomite. The imports of diatomite varied from 33,350 t to 80,088 t, while diatomite exports ranged between 18,339 t and 53,011 t per year.

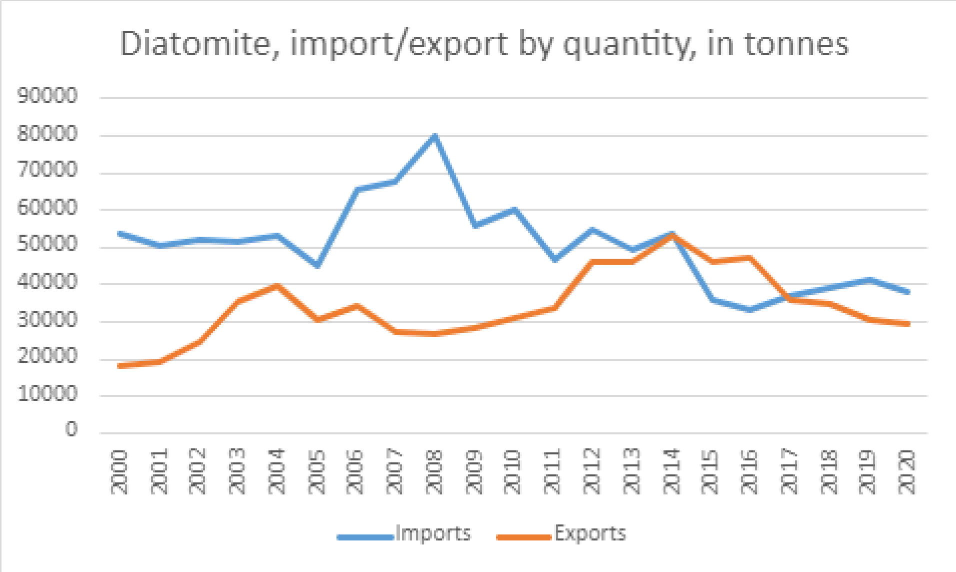

Figure 5. EU trade flows of diatomite (CN 2512 00 00) from 2000 to 2020 (based on Eurostat, 2021)

Figure 6 shows the average EU imports of diatomite by country for the period 2000-2020. The major EU supplier of diatomite was the US, which corresponds to 50% of EU's diatomite imports in the period. Turkey, Mexico, Russia, and Iceland followed with 18%, 15%, 4%, and 3% of total EU's diatomite imports, respectively.

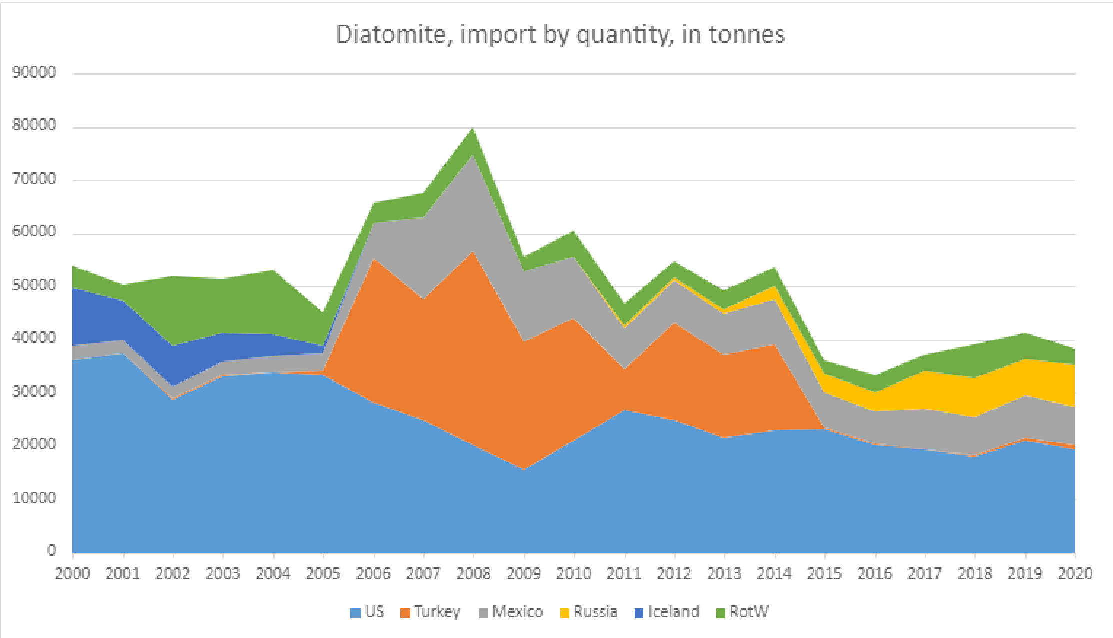

Figure 6. EU imports of diatomite (CN 2512 00 00) by country from 2000 to 2020 (based on Eurostat, 2021)

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PRICE AND PRICE VOLATILITY

The price changes of diatomite are driven by the industrial demand for filtration and microbial removal applications, for example, in beverage, cosmetics, and pharmaceutical industries (Adroit Market Research, 2021). Diatomite price volatility was around 14% between 2016 and 2020. In this period, price volatility was mostly disturbed by the price changes from € 253/t in 2016 to € 319/t in 2017. After 2017, the price volatility of diatomite remains relatively low. Despite the industrial demand changes due to COVID-19, diatomite production has remained steady in the second half of 2020 compared with the same period in 2019 (USGS, 2021). This is also reflected on the annual price trend, where annual prices remain unchanged between 2019 and 2020.

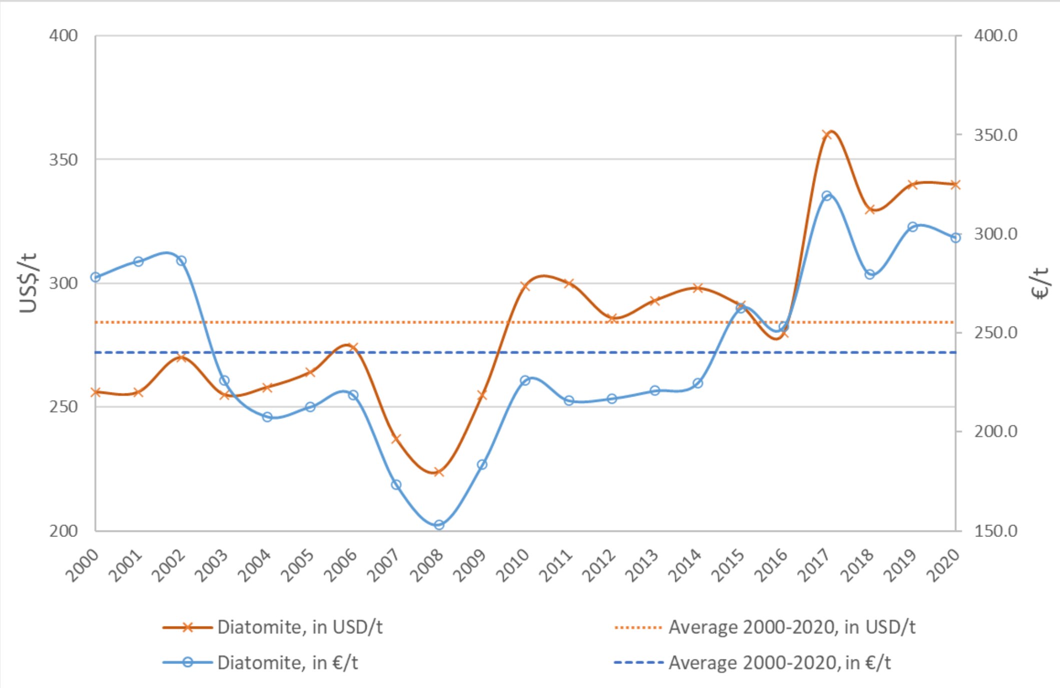

Figure 7. Annual average price of diatomite, in US$/kg and €/kg (based on USGS, 2021)[3]. Dash lines indicates average price for 2000-2020.

OUTLOOK FOR SUPPLY AND DEMAND

Due to the various uses of diatomite in industrial applications (e.g., in crop protection and water treatment), global diatomite demand is expected to increase, albeit not drastically (European Commission, 2020; 2021; SCRREEN, 2021). Global diatomite market will evolve according to the development of the major diatomite application 'filtration' (SCRREEN, 2021). An increased demand for animal feed and agriculture in line with bio-agriculture trends may increase the demand for low-quality diatomite in the coming years (SCRREEN, 2021). The high-quality diatomite consumed by food producers is facing the competition of substitution coming from

[3] Values in €/kg are converted from original data in US$/kg by using the annual average Euro foreign exchange reference rates from the European Central Bank (https://www.ecb.europa.eu/stats/policy_and_exchange_rates/euro_reference_exchange_rates/html/eurofxref-graph-usd.en.html)

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the adoption of new filtering systems (SCRREEN, 2021). Availability of diatomite resources, country risk of diatomite supply and substitutability of diatomite in applications do not give rise to concerns about the ability of supply to adapt to future demand growth.

DEMAND

GLOBAL AND EU DEMAND AND CONSUMPTION

The import of diatomite is mostly determined by the specific properties a certain diatomite mineral needs to have, which can make it economical for the material to be shipped from outside the EU.

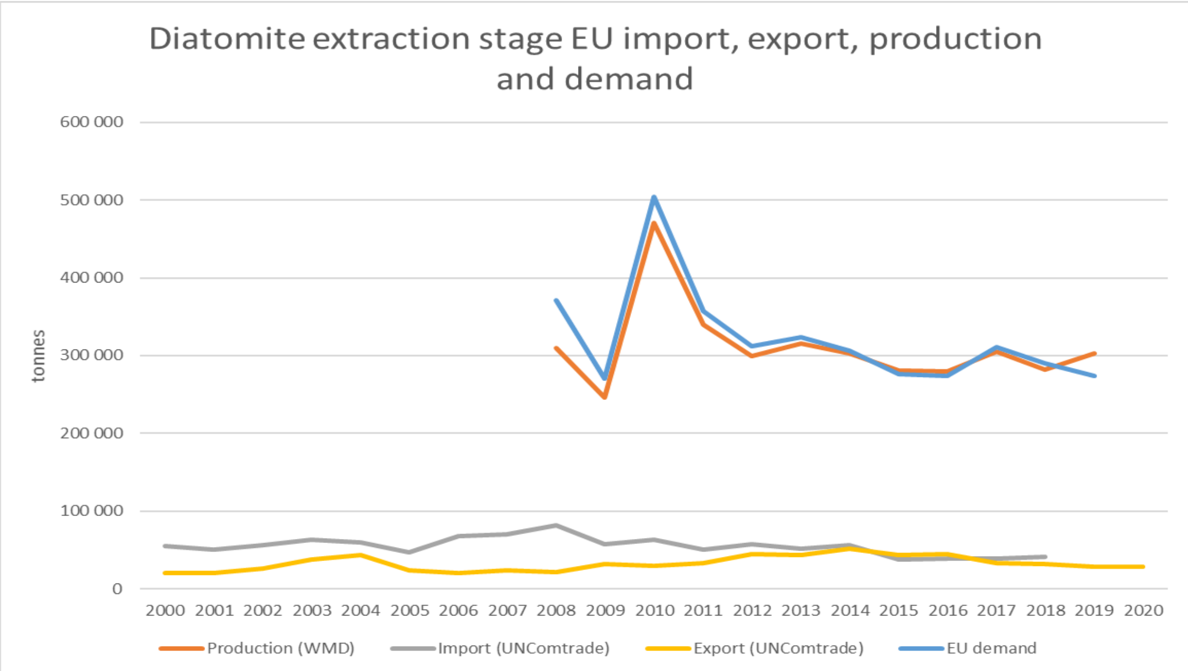

Figure 8. Diatomite (CN 251200) extraction stage apparent EU consumption. Production data from WMD (2021) for diatomite is available for 2008-2020. Import data from UNComtrade (2021) for CN 251200 is available for 2000-2018. Consumption is calculated EU production+import-export.

Diatomite extraction stage EU consumption is presented by HS code CN 251200 Siliceous fossil meals (for example, kieselguhr, tripolite and diatomite) and similar siliceous earths, whether or not calcined, of an apparent specific gravity of 1 or less. Import and export data is extracted from UNComtrade (2021). Production data of diatomite is extracted from WMD (2021).

Based on UNComtrade (2021) and WMD (2021) average import reliance of diatomite at extraction stage is 4 % for 2008-2018.

EU USES AND END-USES

The unique properties of diatomite include being lightweight, having a high porosity, high absorbance, high purity, shape-flexibility and inertness (IMA, 2018).

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In terms of economic sectors, diatomite is allocated to the food industry (filtration aid) (48%), chemical industry and other applications (NACE 23) (49%). Base metal and machinery manufacturing receive smaller shares.

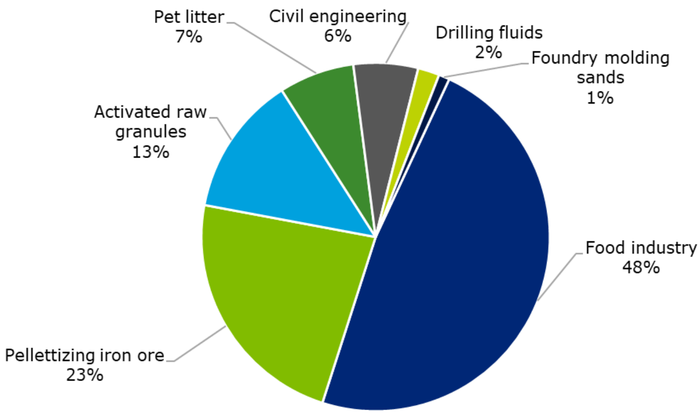

Figure 9: EU end-uses of diatomite (Average figures for 2012-2016. (IMA Europe, 2018)[4] No further update following inputs from SCRREEN experts, 2022)

Relevant industry sectors are described using the NACE sector codes (Eurostat, 2022).

Table 5 Diatomite applications, 2-digit NACE sectors, and value added per sector 2019 (Eurostat, 2022)

Applications	2-digit NACE sector	Value added of sector (millions €) 2019
Food industry	C11 - Manufacture of beverages	251,015 (inc C10 and C12)
Pelletising iron ore	C23 - Manufacture of other non-metallic mineral products	72,396
Activated raw granules	C23 - Manufacture of other non-metallic mineral products	72,396
Pet litter	C23 - Manufacture of other non-metallic mineral products	72,396
Civil engineering	C23 - Manufacture of other non-metallic mineral products	72,396
Foundry moulding sands	C24 - Manufacture of basic metals	63,700

[4] *To our knowledge no updated figures available, as tested in SCRREEN Expert & Validation workshops, 2022*

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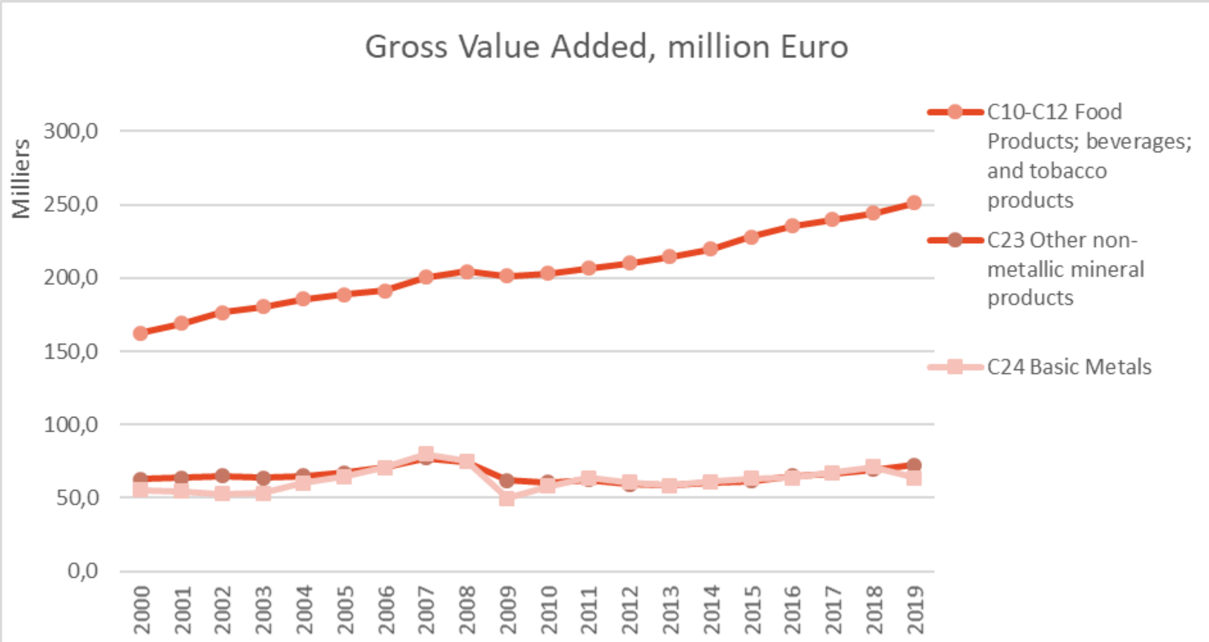

Figure 10 Value added per 2-digit NACE sector over time (Eurostat, 2022)

APPLICATIONS OF DIATOMITE IN THE EU:

Diatomite has a wide range of applications.

Diatomite's combination of high porosity, low density and inertness makes it an excellent **filtration** medium / aid in the food industry, and it is commonly used in the filtration of beverages (beer, wine or juice), wastewater or paints.

Diatomite can remove microscopically small, suspended solids from liquids to process clear filtrates at high flow rates.

Used as **fillers/carriers** (food & beverage manufacturing and chemical industry) and as a filler in rubber or plastic.

As an **absorbent,** with a high capacity for liquids, diatomite variants are used in gas purification processes as well as in the production of pet litter. **Diatomite is further used in the clean-up of spills in different industries (IDPA, 2016).**

Calcined diatomite powder is also used in the **production of explosives or seed coating**. (Inglethorpe, 1993)

4.3 SUBSTITUTION

Although diatomite has unique properties it can be substituted in nearly all applications (USGS, 2022).

FILTRATION

A possible substitute for filtration is expanded perlite.

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Synthetic filters (ceramic, polymeric or carbon membrane) and filters made with cellulose fibres, are becoming competitive as filter media. (USGS,2022).

Bentonite can also be considered as a substitute in filtration (SCRREEN Validation Workshop, May, 2022).

BEVERAGES

In the beverage industry, cellulose or potato starch can replace diatomaceous earth and there are other methods to filter beer such as mechanical centrifuging (USGS, 2016).

FILLERS

Possible substitutes for filler applications are kaolin clay, Ground Calcium Carbonate (GCC), ground mica, perlite, talc, vermiculite and ground limestone (USGS, 2022).

THERMAL INSULATION

For thermal insulation, materials such as various clays, exfoliated vermiculite, expanded perlite, mineral wool, and special brick can be used.

Application	Share*	Substitutes	SubShare	Cost	Performance
Food industry	48%	Expanded perlite	13%	Slightly higher costs (up to 2 times)	Reduced
Food industry	48%	Silica sand	12.5%	Similar or lower costs	Reduced
Food industry	48%	Bentonite	12.5%		
Food industry	48%	Synthetic materials (ceramic/polymer/carbon membranes)	12.5%	Slightly higher costs (up to 2 times)	Similar
Pelletizing iron ore	23%	Bentonite	5%		

***EU end-uses of diatomite (Average figures for 2012-2016. (IMA Europe, 2018)**

SUPPLY

EU SUPPLY CHAIN

The annual average European production of diatomite over 2016-2020 was 352 kt. Denmark, France and Spain were the main producers. A small amount around 35 kt was annually imported in the same period mainly from United States. The exported annual amount does not exceeds 25 kt. China and Switzerland are the main partners in terms of exportation (Eurostat, 2021).

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. Imports of diatomite to Europe from extra-EU countries are mainly from United States, Turkey, Mexico, Russian Federation, China, Armenia and UK.

Diatomite is barely recovered as such during waste management and therefore the contribution from secondary sources is rather limited. During experts consultations (SCRREEN workshops, 2019) it emerged that some forms of functional recycling from uses in civil engineering and foundry could be considered, which correspond to an overall EoL-RIR of 3.5%.

SUPPLY FROM PRIMARY MATERIALS

GEOLOGY, RESOURCES AND RESERVES

GEOLOGICAL OCCURRENCE

Diatomite deposits are formed from accumulated amorphous silica cell walls of dead diatoms in oceans or fresh water. Diatomite deposits are located worldwide. The largest deposits in the world however are found in the USA, followed by China and Turkey (USGS, 2016). Diatomite deposits are frequently associated with volcanic activity. Diatomite is a chalky, sedimentary rock consisting mainly of an accumulation of skeletons remaining from prehistoric diatoms, which are single-celled, microscopic aquatic plants. The skeletons are essentially amorphous hydrated or opaline silica occasionally with some alumina.Most diatomite deposits are found at or near the earth's surface and can be mined by open pit methods or quarrying. Diatomite mining in the United States is all open pit, normally using some combination of bulldozers, scraper-carriers, power shovels, and trucks to remove overburden and the crude material. In most cases, fragmentation by drilling and blasting is not necessary (epa, 1993).

GLOBAL RESOURCES AND RESERVES

Table 6 Global reserves of diatomite estimated in 2021 (USGS, since 2000)

Country	Diatomite Reserves (tonnes)
United States	250,000,000
China	110,000,000
Turkey	44,000,000

EU RESOURCES AND RESERVE

Because every diatomite deposit has a different composition (different diatom species and different chemical fingerprints) which determines its potential market applications and potential economic value, broad summaries of reserves, production and shipments do not paint the full picture. For example, the diatomite deposits from Denmark produce high quality absorbents but cannot be used for filter aids. Other diatomite deposits in the US or China produce excellent filters but are not suitable for granular absorbents. It is generally true, however, that for every application world resources of crude diatomite are sufficient for the foreseeable

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future. Reserve data for some countries in Europe are available at Minerals4EU (2019) but cannot be summed as they are partial and they do not use the same reporting code. Notable reserves of diatomite in Poland have been recently reported and described. Diatomite deposit of about 10 Mt with a 69.2 wt.% SiO2 content occur in Leszczawka area, while prospects for the discovery of larger diatomite deposits, associated with the Menilite series of Krosno strata, exist in the regions of Błaz˙owa-Pia˛tkowa-Harta-Bachórz and Godów (Rzeszów region) and in the Dydynia-Krzywe region (Krosno region) (Lutynski et al. 2019).

Table 7 Reserve data for the EU56 compiled in the European Minerals Yearbook of the Minerals4EU website (Minerals4EU, 2019).

Country	Reporting code	Quantity	Unit	Code Reserve Type
Spain	None	5,010	kt	Proven
Denmark	None	16.1	Million m3	estimated
Czech Republic	Nat. rep. code	1,808	kt	Economic explored
Slovakia	None	2,207	kt	Verified (Z1)

Yearly world production of diatomite can be summarised as follows (average 2016-2020): the United States (800 kt), China (384 kt), Argentina (216 kt), Denmark (120 kt) and Peru (120 kt) are the major producing countries. Production from the United States and China accounts for 46% of the overall supply, equal to approximately 1.2 Mt/y. There are many countries that produce diatomite for their own use, which is reflected in the large share of countries producing smaller quantities (**WMD, 2019**).

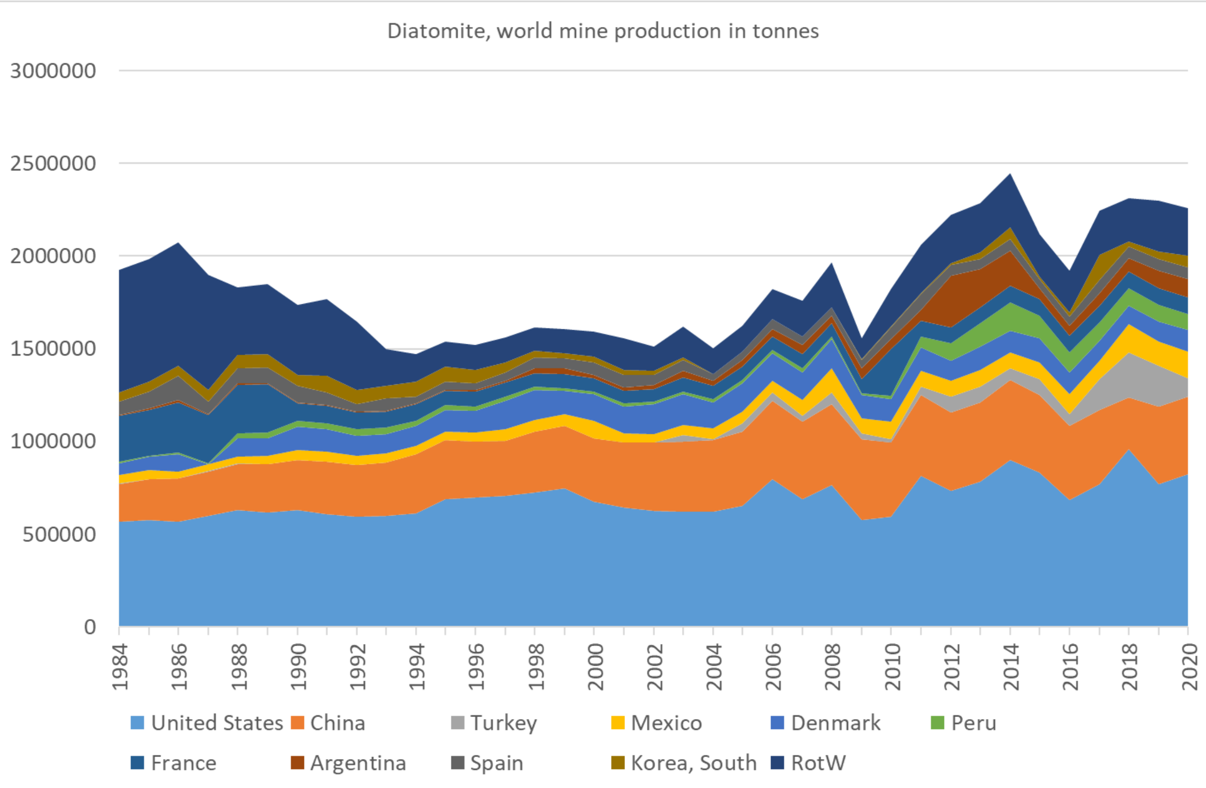

Figure 11. Global mine production of diatomite since 1984 (WMD data).

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In Europe, Denmark is the largest producer (5% of global production) but France is also an important producer (4% of global production). Overall five countries are recorded as diatomite producers in Europe.

The diatomite mining production by country according to WMD since 1984 is presented in Figure 11 (WMD, since 1984; USGS).

SUPPLY FROM SECONDARY MATERIALS/RECYCLING

The recycling rate of diatomite in EU is limited and it is estimated at 4% (era-min.eu, 2021). Due to the complex morphology of the diatom skeletons, it is very difficult to regenerate diatomite filter aids once they have been employed for filtration. Nevertheless, used filter aids are re-used for different purposes, mainly in agricultural industries, e.g. as fertiliser or animal feed. They can also be used in the construction industry (e.g. in the cement industry or the asphalt industry) (Johnson, 1997). Some recent (Chinese) patents have appeared for recycling of diatomite. Semi-industrial tests have shown that spent diatomite sludge by filtration systems can efficiently be used as an additive in ceramic bricks at amounts up to 9 wt.%, without creating a downgrading to their physicochemical and mechanical properties. Furthermore, leached tests of the produced bricks showed a zero ecotoxicity (Ferraz et al. 2011). Spent diatomite sludge from beer production industry has been tested as soil amendment and organic fertilizer to croplands. High concentrations of many macro- and micronutrients, essential for crop growth, are contained in the spent diatomite sludge, while its content in toxi trace elements, such as As, Cd, Pb, Ni, is low compared to the standards set for land application (Dessalew et al. 2017). Spent diatomite filtration cake by wine, beer and juice industries has been used as fertilizer at large scale (9000 tonnes of spent cake) in US (appliedminerals.co.uk, 2016).

PROCESSING OF DIATOMITE

The majority of diatomite deposits occur at or near the earth's surface and they mined by open pit methods or quarrying. The processing of uncalcined natural-grade diatomite mainly consists of crushing and drying. As received mined diatomite contains a moisture content which in many cases exceeds 40 wt.%. Primary crushing to aggregate size, performed by hammermill, is followed by simultaneous millingdrying, in which suspended particles of diatomite are carried in a stream of hot gases. Drying is performed into flash dryers operating at the temperature range between 70 and 430 °C. The suspended particles exiting the dryer pass through a series of fans, cyclones, and separators to a baghouse. Under these steps, diatomite is separated into various granulometric fractions, while the impurities are removed. Diatomite for filtration purposes is necessary to submitted to calcination by heat treatment in gas- or fuel oil-fired rotary calciners, with or without a fluxing agent. Typical calciners operate at temperatures between 650 and 1200 °C. During the calcination process, diatomite powder is heated in large rotary calciners to the point of incipient fusion, therefore the process can be considered a kind of sintering. Calcined diatomite is further milled and classified. Particle size adjustment is succeeded by the addition of a flux, usually soda ash, before the calcining step. The fluxing agent sinters the diatomite particles and increases the particle size and final obtained product is called "flux-calcined” (Figure 12) (EPA, 1996).

A significant number of research studies are focused on the treatment and purification of low grade diatomite materials. Purification by various impurities including Al_2O_3, Na_2O, K_2O, CaO, MgO, Fe_2O_3, can be achieved by

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acid leaching conducted in hot solution (75 °C and 5 M HCl) for long periods up to 240 h. At the same time, an increasing of the specific surface area is performed (San et al., 2009). Purification through scrubbing technique combined with centrifugal separation using sodium hexametaphosphate as dispersant has been also applied. Most of impurities including clay minerals and organic matters are efficiently removed (Sun et al. 2013).

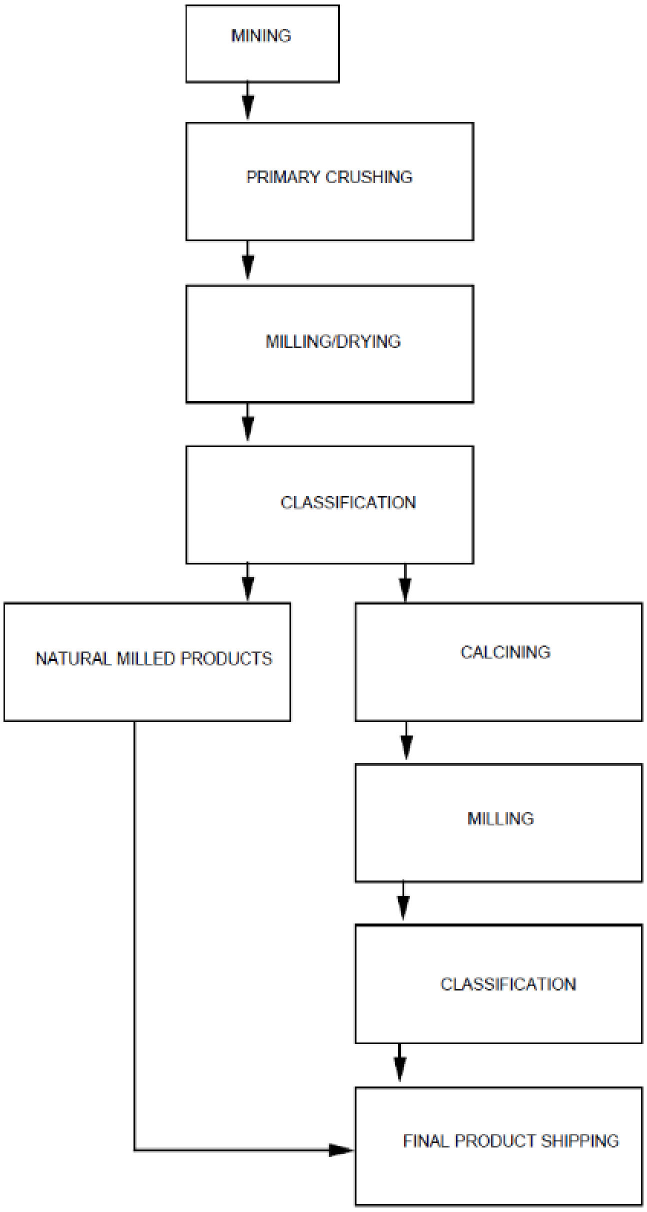

Figure 12 Simplified flowsheet of the diatomite processing (EPA, 1996).

Diatomite has been proposed as an alternative candidate (in respect to pure silica sands) material for the production of solar-grade silicon (SOG-Si) with 99.9999 wt.% purity. A successive acid-leaching purification using HNO_3, HCl, H_2SO_4 was successfully applied for the removal of impurities such as Al Ca Mg Fe B P. The final product consists of a silica with 99.99 wt.% purity suitable to be used as a raw material for SOG-Si synthesis (Abdellaoui et al. 2018).

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OTHER CONSIDERATIONS

HEALTH AND SAFETY ISSUES

During diatomite processing, exposure to crystalline silica (principally cristobalite) can occur when not using the proper health and safety equipment (Checkoway et al. 1993; Industrials Minerals Europe 2011). Recent studies have shown that exposure to respirable crystalline silica dust (RCS) can have negative health effects and in some cases, when having a prolonged exposure can cause damage to the respiratory system and can increase the risk of mortality from lung cancer (Rice et al. 2001; Bunch, Bond, and Stone 2013).

Under Directive 2004/37/EC on the protection of workers from the risks related to exposure to carcinogens or mutagens at work states that work involving exposure to respirable crystalline silica dust generated should be subject to review, in particular in light of the number of workers exposed (Commission 2017). Respirable crystalline silica dust generated by a work process is not subject to classification in accordance with Regulation (EC) No 1272/2008(*Regulation (EC) No 1272/2008 of the European Commission* 2008). Furthermore, it proposes the establishment of a binding European occupational exposure limit at 0.1 mg/m^3 (respirable fraction, 8h TWA) in Annex III (Commission 2017). However, this substance is not restricted under REACH Regulation (EC) No 1907/2006 Annex XVII (Deutsche Forschungsgemeinschaft and Commission for the Investigation of Health Hazards of Chemical Compounds in the Work Area, 2002).

In addition, the Occupational Safety and Health Administration of the United States Department of Labor published in 1970 the threshold limit value of airborne contaminants for construction defined that Amorphous Silica (including natural diatomaceous earth) should have a limit of 20 million of particles per cubic foot of air, based on impinger samples counted by light-field techniques. Furthermore, in the Mineral and Dusts Occupational Safety and Health Standards, Table Z-3 of Mineral Dusts a limit of 80 mg/m^3 was defined (United States Department of Labor 1970; 1993). Safety issues in the end of life phase of products containing crystalline silica dust are the same as in the production, refining/processing and use phase and therefore same standards and regulations apply.

ENVIRONMENTAL ISSUES

No environmental issues were found in the scientific literature review. In addition, no LCAs studies could be found related to any life cycle stage or specific use of the material during the scientific literature review.

NORMATIVE REQUIREMENTS RELATED TO THE USE AND PROCESSING OF DIATOMITE

Technical rules for the use of Diatomite can be found in the GESTIS Substance database[5]. International limit values for Diatomite can be found in the GESTIS international limit values database[6].

[5] See https://gestis-database.dguv.de/data?name=491121

[6] See https://limitvalue.ifa.dguv.de/WebForm_ueliste2.aspx

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SOCIO-ECONOMIC AND ETHICAL ISSUES

ECONOMIC IMPORTANCE OF DIATOMITE FOR EXPORTING COUNTRIES

Globally the diatomite economy is a very small (about 0.0001% of the total world trade market). The market is also very limited for the main producing countries (China 0.002%, USA 0.003%, Italy 0.007%, Spain 0.009%). In 2020, the bentonite export market represented about 0.1 of the total United Republic of Tanzania (COMTRADE, 2020).

SOCIAL AND ETHICAL ASPECTS

No specific issues were identified during data collection and stakeholders' consultation.

RESEARCH AND DEVELOPMENT TRENDS

RESEARCH AND DEVELOPMENT TRENDS FOR LOW-CARBON AND GREEN TECHNOLOGIES

a. R&D trends in terms of emerging LCGT

No research and development trends could be identified in the context of Diatomite use in emerging LCGT.

b. R&D trends in terms of emerging application of RM in already existing LCGT

No research and development projects could be identified in the context of emerging applications of Diatomite in already existing LCGT.

OTHER RESEARCH AND DEVELOPMENT TRENDS

No projects were available.

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