ENVIRONMENTAL FOOTPRINT OF SOME SELECTED INDUSTRIAL MINERALS: A STUDY FROM IMA-EUROPE

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THE STUDY

Understanding the **environmental impact of various industrial minerals,** which are essential to many **consumer products used daily by citizens around the globe** - cars, houses, paper, paint, plastic, glass, public transport, and high tech applications such as turbines or photovoltaic panels - is key to develop into a sustainable economy. Knowledge of **"inputs" and "outputs" in the life cycle inventories (LCIs)** will help companies to identify environmental hot spots within the manufacturing chain that may eventually lead to more sustainable extraction and production processes.

The Industrial Minerals Association-Europe (IMA–Europe) therefore developed **a life cycle inventory publishing performance data for selected high-volume industrial minerals,** which delivers **average representative environmental footprint values** for industrial minerals in Europe. The study is based on the widely accepted ISO 14040-14044 standards.

SCOPE

The IMA LCI scope covers 8 mineral products:

METHODOLOGY

The boundaries of the LCIs were from cradle-to-gate. "Cradle" is defined as being the extraction of the raw material and "the gate" is the last stage on the industrial site before the mineral is shipped to the customer for a particular use. The reference flows were calculated for 1 kg of dry in each respective industrial mineral.

To determine the environmental impact of the industrial minerals, the following steps were assessed within the IMA-Europe LCIs:

1. Raw material extraction
2. Transportation of raw material from quarries to the processing plant
3. Processing stages (crushing, drying, fine grinding) within the industrial site
4. Transportation of the consumable and (semi-)finished products within the industrial site
5. The packaging of the final products

The transportation of the finished products to the customer for the various applications has not been taken into account. The contribution of some production processes is considered negligible for the IMA LCI study. Therefore, the following life cycle stages were omitted from the LCI and data collection, namely the closing and rehabilitation stages in the quarries, capital equipment, and the impact of human activities on-site. **Inputs and outputs above 1% have been collected and calculated in order to allow the computation of the elementary flows.** Data consolidation was carried out by making use of weighting factors calculated by averaging different sites with standard and non-standard processes.

Plant-specific emissions data were collected from all manufacturing companies. The flows for which the data collection was carried out **were resource consumption, air emissions, water effluents, and release to soil.** The intermediate flows were defined as energy and consumables, the co-products, final products, and waste flows. **Eight representative sites were selected for data collection** in six European Union locations (Belgium, Finland, France, Germany, Greece, and two sites in UK), one site was located in Turkey. The collection of data was carried out in 2006 and is representative for the average European performance of the selected industrial minerals. The format used for the presentation of the LCI data is consistent with the requirement of the ISO 14040 – 14044, and has passed the critical review from an independent reviewer.

RESULTS

One important conclusion of this study is that as the end product gets finer it requires further steps in production that increase the energy consumption which, in turn, results in a higher environmental footprint. On the other hand an even more finely processed mineral product may lead to improvements in dosage during the production process for a particular application, which can result in improved environmental overall performance.

Based on the similarities in the production processes, the energy consumption and the similar environmental footprints, it was possible to group the various products into three families. A summary of the environmental impact for the three identified families is shown below.

IMA Europe		**Family I** Calcium carbonate superior to 63 µm Also includes: Wet silica sand, Crude blended feldspar and Ball clay. This family of products corresponds to minerals that are extracted, with or without crushing, and without drying.	**Family II** Kaolin coarse filler Also includes: Dry silica sand. Description: This family of products corresponds to minerals that are extracted with or without crushing before drying.	**Family III** Very fine milled silica sand Also includes: Dry milled feldspar. This family of products corresponds to minerals that are extracted with crushing, dried and finally dry milled
IMPACT CATEGORY	**UNIT**	**REFERENCE FLOW 1kg**	**REFERENCE FLOW 1kg**	**REFERENCE FLOW 1kg**
Primary Energy Consumption	MJ	0.74	2.2	2.86
Water Consumption	litre	0.04	1.61	4.58
Global Warming Potential (GWP)	g eq. CO_2	39.6	92.3	120.3
Acidification	g eq. SO_2	0.09	0.61	0.41
Abiotic Depletion	g eq. Sb	0.3	0.85	1.04

ABOUT IMA-EUROPE

The European Industrial Minerals Association (IMA-Europe) is an umbrella association which brings together nine European and one international association covering more than 500 European producers in the field of industrial minerals. The members of IMA-Europe are specialised in manufacturing tailored products based on the needs of the market and various applications. Some of the main industrial minerals covered by IMA-Europe are the following: calcium carbonate and dolomite (CCA-Europe); borates (EBA); lime (EuLA); andalusite, mica, sepiolite & vermiculite (ESMA); bentonite (EUBA); feldspar (EUROFEL); industrial silica (EUROSIL); talc (EUROTALC); diatomite (IDPA); kaolin and plastic clays (KPC-Europe).

Industrial minerals exist all around us. Their unique qualities have made them a key ingredient in human life throughout the history of civilisation, from its earliest beginnings to contemporary modern manufacturing. Industrial minerals are essential raw materials and form an integral part of modern life: a family house contains up to 150 tons of minerals, and a car up to 250 kg. Minerals make up 50% of paint and up to 50% of paper, whereas ceramics and glass comprise 100% mineral content. Industrial minerals are also essential components of today's most eco-efficient products and technologies such as wind turbines and photovoltaic panels. For more information, please visit: **ima-europe.eu**