European
Federation of
Concrete Admixture
Associations

EFCA ENVIRONMENTAL DECLARATION

AIR ENTRAINING ADMIXTURES – DECEMBER 2005.

AIR ENTRAINING ADMIXTURES

Admixtures are an important component of concrete, together with the cement, water, aggregates and, where applicable, reinforcing steel.

Air entraining admixtures currently make up about 5% of all admixtures sold in Europe.
Air entrainers are based on solutions and blends of abietic acid, natural resins and rosins, synthetic anionic or non-ionic surfactants.
Air entrainers are used to develop a large number of small air bubbles in concrete which are homogeneous and stable after the mixing process. The incorporated air bubbles affect the properties of both the fresh and the hardened concrete. In the fresh state cohesion is increased and the air can significantly reduce any tendency for the mix to bleed. The "ball bearing effect" of the air bubbles lubricates the mix, increasing the workability especially in low cement content or in dry mixes. In the hardened state the remaining air bubbles interrupt the porous system of the concrete, reducing the capillary suction (water adsorption). The bubbles also act as an expansion area for freezing water in the pore system leading to increased freeze-thaw resistance.

This Eco-profile is valid for air entraining admixtures based on anionic and non-ionic synthetic surfactants, alkyl ether sulphates, sulfonic acid and abietic acid,.
These chemicals may be factory blended together and/or with other chemicals to give carefully targeted properties.
The air entrainers are dissolved in water and typically contain 3-12% active matter.

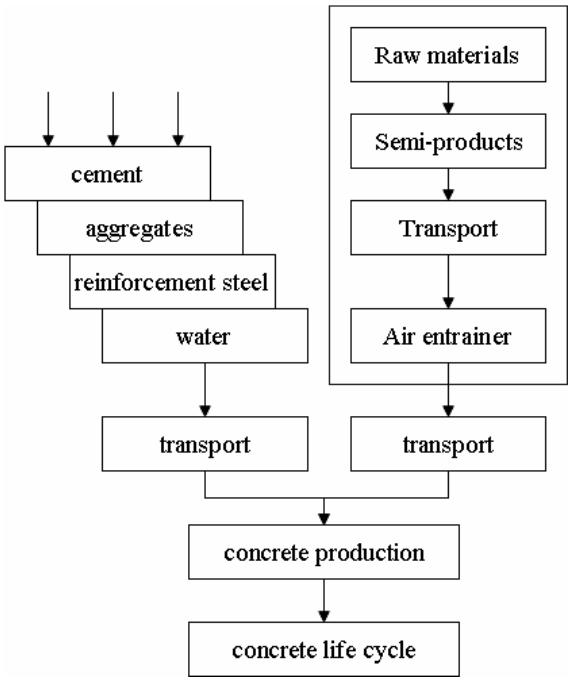
SCOPE OF THE ECO-PROFILE

The Eco-profile covers cradle-to-gate production of air entrainers in Europe. Transport of air entrainers from manufacturer to customer is not included.
Members of EFCA, the European Federation of Concrete Admixtures Associations collected manufacturing data for synthesis and blending of air entrainers in 2005. This environmental declaration is based on the figures from four of Europe's largest

admixture producers and is an average of the air entrainer types described. The variation between these types and between manufacturers leads to relatively small differences in LCA's of concrete, however the figures should not be taken as absolute values for any one manufacturer or air entrainer type.

ENVIRONMENTAL IMPACT

The figure below reveals how the Eco-profile for air entrainers fits in a concrete life cycle. This Eco-profile includes processes shown within the dotted line. To complete the life cycle, environmental data from other materials and processes should be added.



European Federation of Concrete Admixture Associations

ECO-PROFILE AIR ENTRAINERS

Eco-profile for 1 kg air entrainers, 3-14% solids

Raw materials - input	*Unit*	*Value*
coal, brown	g	8.7
coal, hard	g	6.7
crude oil	g	11
natural gas	m3	0.026
Emissions to air		
CO_2	Kg	0.086
CO	g	0.11
N_2O	mg	8.6
NO_x	g	0.35
SO_x	g	0.32
Butane	mg	0.92
Ethane	mg	3.9
Ethene	mg	0.36
Hexane	mg	1.4
Methane	g	0.62
Pentane	mg	1.2
Propane	mg	1.5
Benzene	mg	1.1
PAH	µg	9.1
Ammonia	mg	6.4
Dioxins	µg	0.0072
Arsenic (As)	µg	8.6
Chromium VI (Cr)	µg	3.3
Mercury (Hg)	µg	19
Nickel (Ni)	µg	46
Vanadium (V)	µg	94
CFC-10	µg	0.66
Halon-1211	µg	0.78
Halon-1301	µg	0.29
Emissions to water		
Chemical Oxygen Demand	g	0.59
Oils, unspecified	g	0.059
Nitrogen	mg	25
Nitrate	g	0.24
Phosphate	mg	29
Barite	mg	4.2
Copper (Cu)	mg	0.71
Nickel (Ni)	mg	0.74
Vanadium (V)	mg	0.14
PAH's	µg	5.8

Indicators for 1 kg air entrainers, 3-14% solids

Emissions to soil	*Unit*	*Value*
Chromium VI (Cr)	µg	17
Mercury (Hg)	µg	0.15
Oils, unspecified	mg	37
Metolachlor	mg	1.2
Solid waste		
Non-hazardous waste	g	0.29
Hazardous waste	mg	59
Total energy		
Total energy	MJ	2.1

ACCOUNTABLES

The Eco-profile is derived from primary data supplied by EFCA and its member organisations.

An independent consultancy from The Netherlands, INTRON, verified primary data and computed the Eco-profile.

Additional information for LCA practitioners:

- The Eco-profile on this sheet is valid for admixtures in a range of solids percentages. Even though this percentage may vary substantially it is not a major contributor to the total Eco-profiles and individual admixtures will all be within an acceptable range. The average profile should therefore not be related to the solids percentage of an individual admixture.
- INTRON used literature data on raw material production primarily based upon the Eco-Invent (v1.2) database. Close proximity substitution has been applied.
- Eco-Invent data contain capital goods.
- LCI data for electricity production are based on the European fuel mix.
- Substances that contribute more than 1% to the environmental impact on any of the following environmental categories have been included in the Eco-profile: ADP, GWP, ODP, HTP, TETP, FAETP, POCP, AP and EP.
- The substances in the Eco-profile typically amount to at least 90-95% of the environmental impact in any category.

The membership of EFCA, the European Federation of Concrete Admixture Associations, currently consists of the following national associations:

Belgium	**FIPAH**		
France	**SYNAD**	**Norway**	**NCCA**
Germany	**DB**	**Spain**	**ANFAH**
Italy	**ASSIAD**	**Sweden**	**SACA**
Netherlands	**VHB**	**Switzerland**	**FSHBZ**
United Kingdom	**CAA**		

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