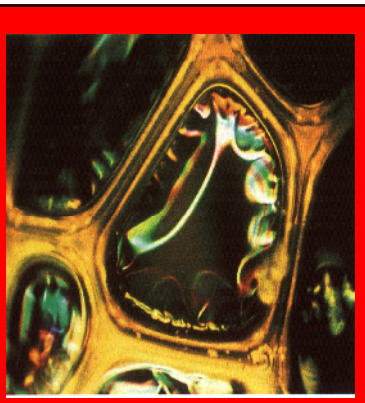
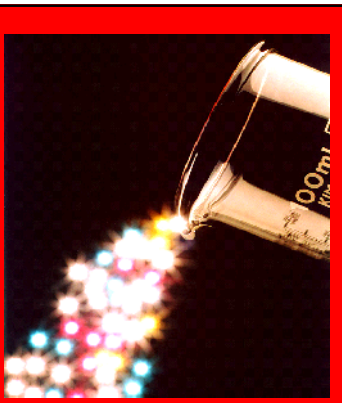
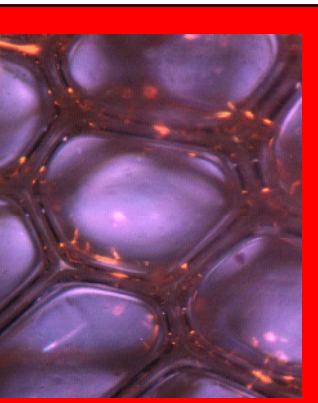
Envirofoam Sustain

Using Natural Oil Chemistry to Help the Planet

A Rigid Polyurethane Foam for Structural Insulated Panels (SIPs)



Envirofoam Sustain is a low-density fire-retardant polyurethane foam for the insulation of discontinuous panels. It is suitable for the production of cold-room and general building panels, particularly those manufactured for SIP applications.

Envirofoam Sustain is the state-of-the-art product for manufacturers requiring a high-performance material with the best possible environmental credentials. In particular, this insulation product exhibits the following unique combination of attributes:

Zero Ozone Depletion Potential.
Polymer derived from renewable vegetable oil.
Blowing agent Global Warming Potential (GWP) of "less than 1".
Very low thermal conductivity.

See overleaf for further details.

Quality Chemicals
for the
Polyurethane Industry

Technical Information

Blowing Agents and the Environment.

Polyurethane foams utilize gaseous blowing agents in order to produce low-density foam insulation products. The blowing agents are incorporated into the resin component of the two-part polyurethane system and these gases are trapped within the very fine cells of the polyurethane matrix. It is the presence of these gases within the foam cells which gives rise to the excellent insulation properties of such foamed products.

However, certain blowing agent gases have come under attack as a result of their perceived environmental properties. The two principal characteristics which have been highlighted over the past decade are the Ozone Depletion Potential (ODP) and the Global Warming Potential (GWP).

The ODP of polyurethane cell gases is a measure of their ability to chemically react with the earth's ozone layer and cause a depletion of ozone in the atmosphere. An efficient ozone layer is required in order to reduce the intensity of ultraviolet light reaching the earth's surface. UV light is known to increase the risk of skin cancer. Today, this aspect of polyurethane chemistry is of little importance since most developed countries in the world now use cell gases which have no adverse effect on the earth's ozone layer. These compounds are said to have an ODP of zero. They were first commercially introduced to the polyurethane market by IFS Chemicals in 1988.

Many of the replacements for ozone-depleting substances were later found to have a negative influence on another perceived environmental effect—the greenhouse gas (or global warming) phenomenon. Whilst carbon dioxide was recognised as the most prolific global warming gas responsible for this effect, other gases, whilst present in smaller amounts, had a greater potential for adding to the global warming problem. For this reason, these gases were given a numerical rating which reflected their potential for global warming in comparison to carbon dioxide. By International agreement, CO_2 was designated as having a GWP of 1. All other gases were rated relative to this value. It was found that many of the replacement gases, which were ideally suited to provide polyurethane foams with excellent insulation values, had very high GWP figures. Some were many thousands of times higher than CO_2. This led to the more recent trend of using newly-developed foam blowing agents with lower GWPs. Several years ago, the Building Research Establishment (BRE) in the UK stipulated a GWP figure of "*less than 5*" in order to meet the requirements of their *Ecohomes* scheme. Generally speaking, the foams in current production in Europe, including the UK, do not meet this requirement, the majority having GWP figures ranging from 6.0 to 2000. No doubt these figures will reduce as the market insists on ever-decreasing values.

In contrast to other products on the market, the GWP of Envirofoam Sustain is 0.7, a value that is unique in the polyurethane industry.

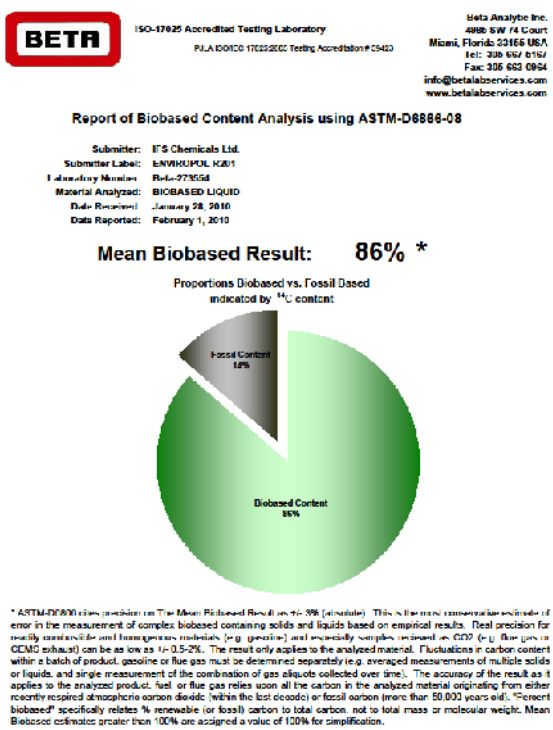
Technical Information

The Polymer Structure and the Environment.

In addition to the environmental benefits arising from a careful selection of blowing agent gases, Envirofoam Sustain contains an advanced polymer manufactured from a totally renewable source. The basic structure of the polyurethane matrix contains a significant portion of polymer derived from rapeseed oil, a source of long-chain triglycerides which are ideal for producing highly-efficient insulation products.

This exciting technology was first described in a paper presented at the 1995 UTECH ASIA CONFERENCE in Singapore. A copy of this paper (Low Cost Polyols from Natural Oils by Barrie.G.Colvin) can be seen at:

http://www.ifs-group.com/downloads/1/envirofoam_low_cost_polyols.pdf



BETA

ISO-17025 Accredited Testing Laboratory

PJLA ISO/IEC 17025:2005 Testing Accreditation # 25403

Beta Analytic Inc.
4985 SW 74 Court
Miami, Florida 33155 USA
Tel: 305 667 5167
Fax: 305 663 0964
info@betalabservices.com
www.betalabservices.com

Report of Biobased Content Analysis using ASTM-D6866-08

Submitter: IFS Chemicals Ltd.
Submitter Label: ENVIROPOL R201
Laboratory Number: Beta-273556
Material Analyzed: BIOBASED LIQUID
Date Received: January 28, 2010
Date Reported: February 1, 2010

Mean Biobased Result: 86% *

Proportions Biobased vs. Fossil Based indicated by ^{14}C content

Fossil Content 14%

Biobased Content 86%

* ASTM-D6866 allows precision on The Mean Biobased Result as +/- 3% (absolute). This is the most conservative estimate of error in the measurement of complex biobased containing solids and liquids based on empirical results. Real precision for readily combustible and homogenous materials (e.g. gasoline) and especially samples reviewed as CO2 (e.g. flue gas or CEMS exhaust) can be as low as +/- 0.5-2%. The result only applies to the analyzed material. Fluctuations in carbon content within a batch of product, gasoline or flue gas must be determined separately (e.g. averaged measurements of multiple solids or liquids, and single measurement of the combination of gas aliquots collected over time). The accuracy of the result as it applies to the analyzed product, fuel, or flue gas relies upon all the carbon in the analyzed material originating from either recently respired atmospheric carbon dioxide (within the last decade) or fossil carbon (more than 50,000 years old). "Percent biobased" specifically relates % renewable (or fossil) carbon to total carbon, not to total mass or molecular weight. Mean Biobased estimates greater than 100% are assigned a value of 100% for simplification.

Since that time, IFS has spent 15 years refining these products, resulting in a unique and versatile polyol, Enviropol R201, which is incorporated into all insulation grades of foam, including Envirofoam Sustain. Independent analysts, Beta Analytics, have measured the percentage of renewable carbon in Enviropol R201 and have obtained a figure of 86%.

The sustainability aspect of this development is clearly significant and must be regarded as the way forward in all future developments. An added benefit is that the conversion of rapeseed oil to Enviropol R201 utilizes only 10% of the energy required in the conventional petrochemical, multistage polyol production process.

Thermal Conductivity

Whilst improving the environmental properties of Envirofoam Sustain, IFS also improved it's well-known microcellular technology, resulting in smaller cell size and improved cell structure. Taken together, these various improvements have led to a significantly improved foam lambda value of 0.021—0.022 W/mK.

Typical Properties of Envirofoam Sustain

Appearance	Resin Isocyanate	Clear, amber liquid Brown liquid
Storage Temperature	Resin Isocyanate	15-25°C 15-25°C
Specific Gravity (20°C)	Resin Isocyanate	1.06 g/cm^3 1.24 g/cm^3
Viscosity (25°C)	Resin Isocyanate	350 mPa.s 240 mPa.s
Mix Ratio (w/w)	Resin Isocyanate	100 120
Cream Time	100g @ 20°C	10 secs
Gel Time	100g @ 20°C	100 secs
Free-Rise Density	Overall	35 kg/m^3
In-Place Density	Overall	42-48 kg/m^3
Compressive Strength @ 10% Compression	kPa	210 @ 39 kg/m^3 Core Density
Thermal Conductivity	Initial	0.0215 W/mK
Tensile Adhesion	To steel	280 kPa
Global Warming Potential		0.7
Flammability	BS 4735	<125 mm mean extent of burn
Cure Time	50 mm thickness 80 mm thickness	20 minutes 25 minutes
Dimensional Stability	-15°C, 7 days	Zero volume change