

Environmental Aspects of Clarifoil Cellulose Diacetate Film

Clarifoil is the trade name for a range of films based on cellulose diacetate. Very glossy, highly transparent films are produced, as well as distinctive semi-matt and matt films, covering a thickness range from 14 μ - 500 μ . The properties of these films reflect their cellulosic origins and thus offer an attractive combination of environmental features. Their cellulosic nature also means that Clarifoil films are often ideally suited to be used in contact with paper and board in packaging applications such as window cartons and film-laminated printed material.

Clarifoil Manufacture

The diacetate raw material is produced by treating cellulose from woodpulp or cotton linters with acetic anhydride. The resulting flake is mixed with a small proportion of plasticiser and traces of anti-block compound and is cast onto a continuous band to produce a non-oriented film with exceptional optical properties.

The major raw material, cellulose, comes predominantly from SFI (Sustainable Forestry Initiative[®]) managed forestry in North America. The (SFI) program is based on the premise that responsible environmental behaviour and sound business decisions can co-exist to the benefit of landowners, manufacturers, shareholders, customers, the people they serve, the environment, and future generations.

The SFI program integrates the perpetual growing and harvesting of trees with the protection of wildlife, plants, soil, water, and air quality. The trees that are harvested are naturally grown and are certified as 100% GM free.

For more information please visit <http://www.aboutsfi.org>

Clarifoil is distinguished from most other thermoplastic films in that it comes from a sustainable resource and its main component is not derived from fossil fuels. The secondary raw material is acetic anhydride, a simple derivative of the everyday tabletop chemical, acetic acid.

A range of different plasticisers are used in Clarifoil films, depending on the end use. These include glycerol triacetate (triacetin), which is itself a direct food additive and can be naturally derived.

EN 13432 / ASTM D 6400 / Vincotte OK Compost Home

The EN 13432 and ASTM D 6400 are the European and American industry standards for industrial **biodegradability** and **compostability** respectively. There are four requirements necessary to gain accreditation to these standards:

- 1) Heavy metal content – The films heavy metal content should fall within a pre-defined level described by the standards.
- 2) Disintegration – The film should disintegrate into pieces <2mm within a 12 week period when subjected to composting conditions.
- 3) Biodegradation – The film must biodegrade within a six month period to at least 90% of a reference cellulose sample.
- 4) Plant eco-toxicity – The resulting compost produced from part 3 is used to grow a selection of plants to ensure any bi-products of degradation are not harmful to plant life.

Clarifoil have attained both the EN 13432 and ASTM D 6400 standards for all standard grades up to and including 106 μ , please see certificates attached. In addition, Clarifoil cellulose acetate films have accreditation to the Vincotte OK Compost Home program which requires biopolymers to be compostable at significantly lower temperatures when compared to industrial conditions. With the increase in popularity of home composting and increasing pressure on efficient waste management on both industry and the public, the OK Compost Home certification is extremely important to the environmental credentials of Clarifoil films.

It should be noted that despite its inherent biodegradability, Clarifoil is very stable and does not break down in normal end-use conditions.

Environmental Legislation

The last few years has seen national and inter-national legislation being introduced worldwide to minimise the environmental burden of packaging materials. In Europe, for instance, legislation is designed to reduce packaging levels wherever possible and to encourage re-use or re-cycling of materials, or alternatively composting or incineration with energy recovery. Targets have been set for recycling and recovery of packaging across the various material types - glass, metals, paper and board, plastics and others.

In the UK, each stage of the packaging chain must pay towards the ultimate recovery costs of post-consumer packaging. **Clarifoil film is classified in the paper and board category in the UK, in view of its cellulosic base.** As a consequence the levy on Clarifoil is lower than that on other thermoplastic films which are classified as plastics.

European legislation also calls for very low heavy metal content in packaging materials, in line with the US Coneg limits. Clarifoil has, for many years, complied with these levels.



Celanese Acetate Limited

Registered in London No. 5859422.

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Recycling with Clarifoil

In principle Clarifoil film is readily recyclable. It is easily re-dissolved and filtered for casting, to yield a first quality recycled film. Since the Clarifoil manufacturing process is relatively low temperature, no thermal degradation of the polymer occurs, as can happen with melt processed polymers. Thus virtually all in-house waste and worthwhile quantities of redundant film from customers is currently re-processed in our plant to produce first quality film.

In practice Clarifoil is usually used in combination with paper or board in packaging applications, either bonded around the edge of a window in a folding carton, or laminated to the surface of printed board, thus other possibilities arise:

Repulpability

Because of its predominantly cellulosic nature, it is feasible that Clarifoil can be recycled along with paper in a re-pulping process. Independent laboratory tests have demonstrated that approx 50% of a 28 μ Clarifoil film can be successfully repulped along with paper and board to produce recycled paper. However, these tests did not take into consideration some of the more aggressive conditions often found at paper mills, and only used hot water as the re-pulping matrix. Further independent studies are underway at Pira to see what effect a caustic environment has on the repulpability of cellulose acetate film according to recognised FINAT and INGEDE standards.

Incineration with Energy Recovery

Where mixed waste arises, in many cases the most sensible disposal option is to incinerate at high temperature with energy recovery, rather than to attempt to separate materials and process them down different waste streams. Fully combusted Clarifoil produces only carbon dioxide, water and a little non-toxic inorganic ash. It has a calorific value around 20MJ/kg, making it worthwhile to recover the energy for heating purposes.

Summary

Clarifoil is derived mainly from sustainable non-fossil fuel resources. Its cellulosic origin provides a number of attractive environmental options and gives it a unique versatility for packaging waste recovery.

For additional guidance or technical information contact Clarifoil Technical Support:

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Fax: 00 44 1332 660178

e-mail: tony.longdon@clarifoil.com or kevin.parker@clarifoil.com



Gesellschaft für Konformitätsbewertung mbH



NOTIFICATION OF REGISTRATION

The company

Clarifoil
1 Holme Lane
SPONDON, DERBY DE21 7BP
GREAT BRITAIN

hereby receives the confirmation that the product/s

Compostable intermediates

of the type

P20 Film

conforms to

DIN EN 13432:2000-12

Certification scheme products made of compostable materials

Registration No.: 7H0021

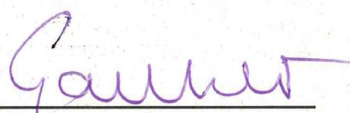
This Notification of Registration is valid in connection with above stated Registration No.
for an unlimited period and becomes ineffective only upon termination.

See annex for further information.

DIN CERTCO Gesellschaft für
Konformitätsbewertung mbH
Alboinstraße 56, 12103 Berlin



2006-12-07


Dr.-Ing. Michael Garmer
- Managing Director, Head of Certification Body -

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W: ineseacetate.com

CERTIFICATE

THIS IS TO CERTIFY that the following product has been found to comply with the specifications established in the American Society for Testing and Materials standard ASTM D6400, "Standard Specifications for Compostable Plastics", in accordance with the terms and conditions of the " Biodegradable Products Institute and The United States Composting Council – Certification Program for Products Made of Compostable Plastics – Program Rules":

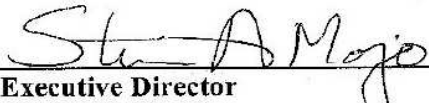
Product

- **Cellulose acetate based plasticized films manufactured by Clarifoil with a maximum thickness of 106 microns and sold under the trade name Clarifoil.**

as further described in the application and related information submitted to the Biodegradable Products Institute by Clarifoil (the "Licensee") of Spondon, Derby, Great Britain.

This Certificate authorizes the Licensee, for three (3) years beginning on the date below, to use the Certification Program Logo depicted below in relation to such Product, subject to all conditions and terms of the Program Rules and the License Agreement between Biodegradable Products Institute and the Licensee.



By: 
BPI Executive Director

Date: February 16, 2007



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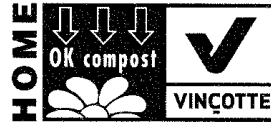
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CERTIFICATE FOR AWARDING AND USE OF THE 'OK COMPOST HOME' CONFORMITY MARK

No. O08-217-A

Issued by **AIB-VINÇOTTE International**

For the product(s) described hereafter :

Product group :	Biomaterial
Product family :	Bioplastics
Make :	Clarifoil
Type(s) :	P20 Film
Particularities :	Thickness : max 106 µm Color : Transparent

Conformity examination applied for by :

CLARIFOIL
1 Holme lane,
Spondon, Derby
DE21 7BP
UK

Criteria for certification :

- AVI Test Program with reference OK 2 - edition C "Home compostability of products"

Validity of the certificate :

From 13 March 2008 till 13 March 2013

Conclusions of the examination :

The products comply with the above mentioned certification criteria, as confirmed by the test report of AVI no 09 / 60211690 / 803057 p

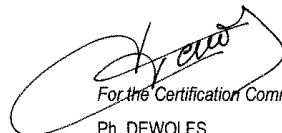
Applicable certification system :

Type examination followed by supervision through verification tests on samples from the distributor's stocks.
The conformity of the product is guaranteed by the procedures for awarding and use of the 'OK Compost HOME' conformity mark. This only applies for specimen bearing the 'OK Compost HOME' mark.

This certificate is issued in English.

Brussels, 13 March 2008,


S. VANGESTEL
Contract Manager


For the Certification Committee
Ph. DEWOLFS
President of the Committee

D 056 00 01

V-CERTOKH-e