

# “FEFCO Biodegradability and compostability of corrugated boxes”

## Introduction

The EU Commission has introduced the Circular Economy Package that consists of an EU Action Plan for the Circular Economy. Existing EU waste policies contribute to move towards a circular economy.

The EU Packaging and Packaging Waste directive covers all packaging placed on the European market and all packaging waste, whether it is used or released at industrial, commercial, office, shop, service, household or any other level, regardless of the material used.

The requirements placed by the EU Packaging and Packaging Waste Directive (94/62/EC) on packaging in EU are:

1. Collection and recycling requirements
2. Construction requirements.

In turn, the packaging construction requirements are set out in the EU directive as the Essential Requirements, and involve the following:

- The weight and volume of the packaging must be kept to a minimum
- The packaging should permit re-use or recycling/material recovery
- The content of harmful and hazardous substances must be minimised

These requirements apply to all packaging placed on the European market.

The European Committee for Standardisation, CEN, has developed six standards which detail how to evaluate whether packaging meets the above essential requirements:

- Prevention of waste (EN 13428:2004)
- Re-use (EN 13429:2004)
- Material recovery (EN 13430:2004)
- Energy recovery (EN 13431:2004)
- Composting and biodegradation (EN 13432:2000)
- Instructions for applying the above standards (EN 13427:2004)

Corrugated packaging can often be re-used and if not, they are well suitable for material recovery.

Under certain conditions, it may be appropriate to have composting as an alternative and in this study Fefco wished to investigate the availability and results of reports on the biodegradability and compostability of corrugated boxes as a product

# Aim of the study

The aim of the study was to perform a literature study with focus on research reports from Europe and US/Canada regarding biodegradability and compostability of corrugated boxes. To synthesize results from fact-based studies and research, that can be used to backup communication on biodegradability or compostability of corrugated boxes.

# Project activities

The main project activities were based on an overview of available reports, abstracts, and research articles in Europe and US/Canada, followed by a literature review combined with RISE expertise within the pulp, fiberbased material and sustainable packaging area.

The study included reports of biodegradability and compostability for corrugated sheet (only paper + starch) and for corrugated boxes (printed and glued).

Contacts were taken with information expert at RISE, with Swedish institute for Standards, German institute for Standards, Organic Waste Systems in Ghent Belgium, RISE UK, sites that performs compostability studies, industry organizations and research institutes.

The initial criteria set for the literature study by the project partners were to focus on *“biodegradability and compostability of corrugated boxes”*. This resulted in a small amount of studies, so the scope was extended to also include studies from corrugated board material and other fiberbased packaging materials.

# Results

It is considered to be obvious that corrugated cardboard is compostable, and this is probably why only a few detailed research studies have been carried out regarding compostability and biodegradability of corrugated cardboard

The extensive literature overview in this project resulted in 58 articles/reports and in the first step 19 were selected. After a review of the selected reports only 9 reports remained to be studied more in detail. Those reports had the right focus, were extensive, detailed and transparent studies.

Number	Name File	Authors	Title	Company/Institutional Source	Journal	Country	Year	Material	Method	Comments
14	14 Biodegradability of Biological Solid Waste Compost Under Specific Conditions	WILLIAMS, ELIZABETH WILLIAMS	Biodegradability of Biological Solid Waste Compost Under Specific Conditions	North Carolina State University	Environ. Sci. Technol.	USA	1997	compost	compost	
15	15 THE VALUE OF COMPOSTED CORRUPTIBLE COMPOSTING	WILLIAMS, ELIZABETH WILLIAMS	THE VALUE OF COMPOSTED CORRUPTIBLE COMPOSTING	University of Georgia		USA	1996	compost	compost	
16	16 Characterization of Compost Derived From Municipal Solid Waste	YOUNG, S.C. CHANG	Characterization of Compost Derived From Municipal Solid Waste	North Carolina State University	Environ. Sci. Technol.	USA	1997	compost	compost	
17	17 Preparation for Biodegradability and Compostability of Compost	DE VILDE, M. B. J.	Preparation for Biodegradability and Compostability of Compost	Organic Waste Systems Ghent	Environ. Sci. Technol.	Belgium	1998	compost	compost	Threat and
24	24 Characterization of Compost Derived From Municipal Solid Waste	L. De Boer, S. De Boer, M. B. J. De Vilde, M. B. J. De Vilde	Characterization of Compost Derived From Municipal Solid Waste	Organic Waste Systems Ghent	Environ. Sci. Technol.	Belgium	1998	compost	compost	
25	25 Biodegradability of Compost Derived From Municipal Solid Waste	L. De Boer, S. De Boer, M. B. J. De Vilde, M. B. J. De Vilde	Biodegradability of Compost Derived From Municipal Solid Waste	Organic Waste Systems Ghent	Environ. Sci. Technol.	Belgium	1998	compost	compost	
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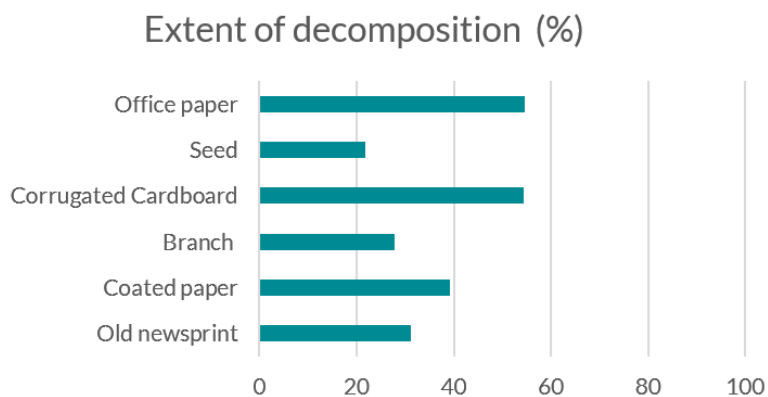


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The results show that information and data from the selected reports can be used to backup communication on biodegradability or compostability of corrugated boxes.

In the report “Characteristics of Composts Derived from Waxed Corrugated Cardboard”, the objective was to evaluate the effects of including waxed corrugated cardboard (WCC) on the quality of composts produced in combination with spent mushroom substrate (SMS) and pulverized wood wastes. The results from the study demonstrated that Waxed corrugated board was easily decomposed during composting and, in this regard, is an excellent feedstock material.

In the report “Biodegradability of Municipal Solid Waste Components in Laboratory-Scale” Landfills the objective was to characterize the anaerobic biodegradability of municipal refuse components. One of the components selected for the study were old corrugated containers. The experiments were conducted in 2-L reactors. The extent of decomposition for old corrugated cardboard was 54,4%, for office paper 54,6%, coated paper 39,2%, old newsprint 31,1%



The extent of decomposition for old corrugated cardboard was 54,4%.

The results show that the decomposition of old corrugated cardboard are equal to the decomposition of uncoated paper which indicate that corrugated cardboard also must be a biodegradable and compostable material due to that paper made from virgin kraft unbleached softwood pulp was one of the material used when the method for the standard EN13432 was developed.

Results from the selected reports demonstrates that

- Waxed corrugated board is easily decomposed during composting and, in this regard, is an excellent feedstock material<sup>1</sup>
- Decomposition of old corrugated cardboard is equal to the decomposition of uncoated paper which indicate that corrugated cardboard also must be a compostable material<sup>2</sup>
- Waxed corrugated cardboard is a very good source of carbon and may be composted with broiler litter or hen manure successfully.<sup>3</sup>



<sup>1</sup> “Characteristics of Composts Derived from Waxed Corrugated Cardboard”

<sup>2</sup> Biodegradability of Municipal Solid Waste Components in Laboratory-Scale Landfills”

<sup>3</sup> ”Hall county waxed corrugated cardboard composting pilot project”

- Corrugated board waste components have a higher aerobic biodegradability than newspapers and magazines<sup>4</sup>



In the report “Determination of the aerobic biodegradability of polymeric material in a laboratory controlled composting test”, the test was designed to become a European Standard in connection with determining the compostability of packaging and packaging materials.

The test results confirm that the test method is suitable for investigating the ultimate aerobic biodegradation of an organic test material in a composting environment. The tests that were performed to develop a method for a material to be approved as compostable according to standard EN 13432 are based on tests carried out on 3 different materials, kraft packaging paper, biocel and avicel.

The results were based on CO<sub>2</sub> evolution and expressed as percentage of the theoretical. Paper (paper made from virgin kraft unbleached softwood pulp) showed a biodegradation of about 80%, the mean degree of Biopol biodegradation was 88% and Avicel was degraded to about 84% on average.

In this study no tests were carried out on corrugated cardboard, but it was considered that the test results confirm that the test method is suitable for investigating the ultimate aerobic biodegradation of an organic material such as corrugated board in a composting environment.

The results from the selected reports demonstrates that corrugated board is a biodegradable and compostable material.

How efficient the compostable/biodegradable process of corrugated board is, depends of the conditions under which the process is carried out

## Communication of results

The results from this study are presented in a power point report and in this short summary. Deliverables in the project are the presentation, the summary and the selected reports.

The study was conducted by Cathrine Löfgren at RISE, Research institutes of Sweden on behalf of Fefco, The Federation of Corrugated Board Manufacturers in the spring of 2020.

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<sup>4</sup> “Characterization of selected municipal solid waste components to estimate their biodegradability”