TAPPI PROCEEDINGS 1997

1997 Polymers, Laminations, & Coatings Conference Book 2

August 24-28, 1997
Sheraton Centre
Toronto, Ontario, Canada

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TAPPI's Antitrust Policy and Compliance Procedures

"Accomplishment of these objectives is everyone's responsibility. We also urge you to advise your colleagues and corporate officers of TAPPI's . . . compliance program"

This article sets forth TAPPI's antitrust policy and the rules of conduct and compliance procedures which govern all TAPPI activities. These formal guidelines are intended to do two things: (1) to prevent the occurrence of an actual antitrust violation in the course of TAPPI activities, and (2) to prevent inadvertent conduct which might give the appearance of an antitrust violation to someone unfamiliar with TAPPI's nature and purposes. They are designed to protect you, your employer and TAPPI from any accusation of wrongdoing arising out of your participation in TAPPI activities.

Accomplishment of these objectives is everyone's responsibility. We urge you to keep this article handy, and to refer to it whenever you have any question about the antitrust implications of any activity you might undertake under the auspices of TAPPI. We also urge you to advise your colleagues and corporate officers of TAPPI's comprehensive antitrust compliance program, so that you can count on their continued support in your TAPPI activities.

Any questions you or your company's legal counsel may have concerning TAPPI's antitrust compliance program should be directed to the Executive Director, TAPPI, Technology Park/Atlanta, P.O. Box 105113, Atlanta, Georgia 30348-5113 or to TAPPI's antitrust counsel, Peter Kontio, Alston & Bird, One Atlantic Center, 1201 West Peachtree Street, Atlanta, GA 30309; Phone (404) 881-7000, TELE FAX (404) 881-7777.

STATEMENT OF ANTITRUST POLICY

TAPPI is a professional and scientific association organized to further the application of the sciences in the paper and related industries. Its aim is to promote research and education in the areas of interest of its members. TAPPI is not intended to, and may not, play any role in the competitive decisions of its members or their employers, or in any way restrict competition in the paper and related industries.

Through its short courses, technical conferences and other activities, TAPPI brings together representatives of competitors in the paper and allied industries. Although the subject matter of TAPPI activities is normally technical in nature, and although the purpose of these activities is principally educational and there is no intent to restrain competition in any manner, nevertheless the Board of Directors recognizes the possibility that the Association and its activities could be seen by some as an opportunity for anticompetitive conduct. For this reason, the Board has taken the opportunity, through this statement of policy, to make clear its unequivocal support for the policy of competition served by the antitrust laws and its uncompromising intent to comply strictly in all respects with those laws.

In addition to the Association's firm commitment to the principle of competition served by the antitrust laws, the penalties which may be imposed upon both the Association and its individual and corporate members involved in any violation of the antitrust laws are so severe that good business judgment demands that every effort be made to avoid any such violation. Certain violations of the Sherman Act, such as price-fixing, are felony crimes for which individuals may be imprisoned for up to three (3) years or fined up to $350,000, or both, and corporations can be fined up to $10 million for each offense. In addition, treble damage claims by private parties (including class actions) for antitrust violations are extremely expensive to litigate and can result in judgments of a magnitude which could destroy the Association and seriously affect the financial interests of its members.

It shall be the responsibility of every member of TAPPI to be guided by TAPPI's policy of strict compliance with the antitrust laws in all TAPPI activities. It shall be the special responsibility of committee chairmen, Association officers, and officers of Local Sections to ensure that this policy is known and adhered to in the course of activities pursued under their leadership.

To assist the TAPPI staff and all its officers, directors, committee chairmen, and Local Section officers in recognizing situations which may raise the appearance of an antitrust problem, the Board will as a matter of policy furnish to each of such persons the Association's General Rules of Antitrust Compliance. The Association will also make available general legal advice when questions arise as to the manner in which the antitrust laws may apply to the activities of TAPPI or any committee or Section thereof.

Antitrust compliance is the responsibility of every TAPPI member. Any violation of the TAPPI General Rules of Antitrust Compliance or this general policy will result in immediate suspension from membership in the Association and immediate removal from any Association office held by a member violating this policy.

TAPPI GUIDELINES FOR SUBMITTING COPIES OF CORRESPONDENCE TO TAPPI HEADQUARTERS

TAPPI headquarters needs to remain aware of what particular committees and Sections of TAPPI are doing or are planning to do in order to better assist those groups in achieving their objectives and to continue to supervise actively the antitrust compliance of TAPPI. The Board of Directors of TAPPI therefore has adopted this formal statement of TAPPI's policy which requires that persons corresponding or receiving correspondence on behalf of TAPPI provide copies of the type of correspondence outlined below to the appropriate liaison person at TAPPI headquarters.

For this policy TAPPI does not require copies of routine, written communications regarding arrangements for speakers, meetings, travel, dinner reservations and the like.

TAPPI headquarters does require that copies of correspondence of an important nature and of non-routine matters be supplied in a timely fashion to TAPPI headquarters personnel connected with the committee or Section involved as shown below:

1. Plans regarding the activities of TAPPI committees or Sections.
2. Communications with other TAPPI committees or Sections.
3. Communications with persons or organizations outside TAPPI.
4. All written or recurring verbal complaints or criticisms of TAPPI activities.

All correspondence falling under the above-stated policy must be forwarded promptly to the appropriate TAPPI headquarters liaison person, preferably at the time of transmittal or receipt.

TAPPI GUIDELINES FOR MANUFACTURING PLANT TOURS

Manufacturing plant tours in connection with TAPPI technical program activities provide an opportunity for observation of applied science and technology. On-site inspection of equipment and processes by program attendees serves to promote knowledge of advances in manufacturing processes. Sponsored plant tours are conducted for the purpose of promoting understanding of production techniques and alternative approaches to technical problems in areas such as safety, pollution control, noise abatement and energy conservation. They may also promote the practical education of new TAPPI members and student members.

TAPPI's General Rules of Antitrust Compliance forbid the use of any TAPPI activity, including plant tours, for the purpose of exchanging competitive information.

In order to assure compliance with TAPPI's antitrust policy and general rules in connection with plant tours, the TAPPI Board of Directors has adopted the following supplemental guidelines to cover the plant tour portion of TAPPI programs:

1. Participation in plant tours should be limited to meeting registrants.
2. Plant tours should not include any discussion or exchange of competitive information.
3. Participants in plant tours should not under any circumstances discuss or otherwise disclose proprietary information.
4. Plant tour participants should not divulge to each other any operating data which could be used to reveal competitive information.
5. Plant tour participants may discuss the productive capacity of particular processes or items of equipment, but may not discuss the planned utilization of such productive capacity by the host plant or any other producer.
6. Plant tour participants may discuss production cost savings which may be effected through the use of a particular process or piece of equipment, but may not discuss the overall production costs of the host plant or any other producer.
7. The plant tour is to be conducted in compliance with TAPPI's Antitrust and Plant Tour Guidelines outlined in these pages, as well as the rules and directives of the host plant. While TAPPI encourages participation by all registrants for the plant tour, a host plant may decide to restrict or limit tour participation. It is the responsibility of those arranging plant tours to inform affected registrants of the restrictions as far in advance of the tour date as possible.

GUIDELINES FOR ANTITRUST COMPLIANCE BY DIVISION AND COMMITTEE OFFICERS

DO's and DON'Ts for Meetings and Operations

DO send the agenda for all meetings to TAPPI headquarters c/o Technical Division Administrator 15 days prior to the meeting.

DO send all minutes to TAPPI headquarters 30 days after the meeting.

DO review TAPPI Antitrust Policy and General Rules of Antitrust Compliance prior to the meeting.

DO stop any discussion which appears to be leading to:

(a) discussion of prices or pricing policy,

(b) any restraint on competition of any kind.

DO advise all meeting attendees to observe the General Rules of Antitrust Compliance in informal conversations as well as formal TAPPI activities.

DO NOT place constraints on committee membership, other than the member's technical capability in the area covered by the committee and the willingness of the committee member to participate actively in committee work.

DO NOT undertake any committee activity involving collection or dissemination of prices or pricing methods.

DO NOT undertake any committee activity involving collection of individual firm cost data or dissemination of any compilation of such data without prior approval of TAPPI legal counsel.

DO NOT undertake any activity to establish a product standard or specification. All test methods must be cleared by TAPPI headquarters prior to publication.

DO NOT set a numerical limit on committee size unless membership on the committee is rotated on a regular and reasonable basis. You may set a numerical limit on the maximum number of representatives per company.

RECOMMENDATIONS FOR THE SELECTION OF SPEAKERS

TAPPI technical sessions at conferences and short courses are not designed to be sales forums; they are designed to provide a forum for the exchange of technical information. Nevertheless, employees of suppliers are sometimes asked to participate as speakers or panelists because of their knowledge and experience. Participation on the program of a conference or short course may be viewed by suppliers as a significant competitive opportunity, and the favoring of some suppliers over others can give rise to antitrust problems. The exclusion of a supplier from a panel or program will not be considered an antitrust violation unless it constitutes an unreasonable restraint on competition. The key to "reasonableness" in this area is fair-minded decision making based upon objective criteria. In order to be fair to all suppliers and to avoid a charge of acting unreasonably to deprive any supplier of a significant competitive opportunity, TAPPI session developers should in all cases observe the following guidelines:

1. No speaker should be chosen with the intent to afford his company a competitive advantage, and no speaker should be excluded with the intent to deny any company a competitive opportunity.
2. Speakers should be chosen individually on the basis of objective criteria reasonably related to the educational purpose of the session, such as technical knowledge, experience, professional reputation, and effectiveness as a speaker.
3. The criteria to be used in selecting speakers should be established prior to the actual selection of speakers.
4. Supplier participation should be planned so as to minimize any competitive advantage which might arise from participation in a TAPPI activity.
5. Consideration should be given by session developers to all available methods for equalizing the competitive opportunity among suppliers.

CONTENTS

Session Number	Title Author(s)
11-1	Unique New Co-Polyesters for Flexible Films and Coatings **Bruce W. Foster** / 333
11-2	Guide to Nylon Chemistry, Equipment & Processing (Coating and Casting) **Dragan Djordjevic** / 341
11-3	The Utility of Polyolefin Plastomers and Ethylene Acrylic Acid Copolymers in Applications Requiring Dissimilar Sealants **Tim J. Pope** / 383
11-4	Coatings & Laminates of Improved Ethylene Alkyl Acrylate Copolymer with Polypropylene and Polyester **Richard Schmidt** / 397
12-1	Antifog Additives for Extruded Film **J. A. Falter, K.S. Geick, and J.B. Williams** / 417
12-2	Modification of the Surface Properties of Polyethylene Plastomers by the Use of Additives (II) **Adam Maltby and Richard Marquis** / 423
12-3	Surface Properties of Corona-Treated Polyethylene Films Containing N-(2-Hydroxyethyl) Erucamide as Slip Agent for Enhanced Adhesion of Water-Based Ink **Bing-Lin Chen** / 427
12-4	Advances in the Masterbatches for the Polyolefin Industry **Prakash R. Patel and Victor J. Mimeault** / 439
12-5	Evaluation of Various Alternative Stabilization Systems for Polyethylene Film Applications **R. E. King, III and Anunay Gupta** / 443
12-6	Evaluation of Coated Ground Calcium Carbonate in Linear Low Density Polyethylene Film **Susan L. Johnson and Tanweer Ahsan** / 471
13-1	AMOSROB® Oxygen Scavenging Concentrates for Rigid Containers, Flexible Films, and Closure Liners **Michael G. Cernak and Weilong L. Chiang** / 479
13-2	A Unique Approach to the Quality Control of Packaging Materials through Aroma Analysis **Jennifer A. Cyr** / 493
13-3	High Barrier Properties of Polymer Films through Specifically Adapted Coating and Laminating Materials **H. G. Bader, S. Amberg-Schwab, M. Gessler, M. Hoffmann, H.-C. Langowski, and U. Moosheimer** / 499
13-4	Nylon-Containing Ionomer Improves the Performance of Ethylene Vinyl Alcohol (EVOH) Copolymers in Multilayer Structures **A. I. Fetell** / 503
13-5	Organic Vapor Barrier: An Important Attribute for the Packaging of Reduced-Fat Foods **Jan Crum and Joanna Hillegeer** / 507
14-1	Extrusion Coating Today and Tomorrow **Dragan Djordjevic** / 519

CONTENTS

Session Number	Title Author(s)
14-2	Film Formation of Polymer Dispersion Film Observed by AFM **Tomi Kimpimäki and Antti Savolainen** / 529
14-3	Development of an Automatic Laser-Based Film Inspection Test Method **Lisa Schmidt** / 533
15-1	Heat Seal-Induced Pinholing in Double-Coated Paperboards **Dorene H. Smith and Ray Edwards** / 537
15-2	A Novel Software System for Evaluating, Storing and Retrieving Polymer Property Data **Natti S. Rao** / 547
15-3	Achieving LDPE Coating Adhesion to Clay-Coated Board Using Calcium Carbonate Addition **F. A. Ruiz** / 555
15-4	Adhesion in Extrusion Coating of Dispersion Coated Paper/Paperboard **Mika Vähä-Nissi, Tomi Kimpimäki, Jurkka Kuusipalo, and Antti Savolainen** / 559
16-1	New Resins for Fresh-Cut Produce Packaging **Jeffrey J. Wooster** / 567
16-2	Unipol II LLDPE Polyethylene Blown Film Resin for Extrusion on HP-LDPE Equipment **G. E. Ealer, J. O. Bühler-Vidal, S. A. Kupperblatt, F. H. Moy, and D. J. Rickman-Davis** / 577
16-3	New Spherilene Terpolymers Provide a Vehicle for LDPE Displacement **George Panagopoulos, Jr. and Roger D. Kamla** / 609
16-4	The Use of Ethylene Plastomers to Improve Polyethylene Films **Richard W. Halle** / 625
16-5	Blends of mLLDPE with MMW-HDPE for Films with Improved Property Stiffness Balance **Debra J. Houska and Steve A. Best** / 633
16-6	ELITE* Enhanced Polyethylene Resins: The New Choice for High Performance, Cold Temperature, Food Packaging Applications **Tracey D. Stirling** / 639
16-7	High Performance Linear Low Density for Blown and Cast Films **Amy B. Hitchcock** / 647
18-1	Statistical Analysis of the Effects of Ozone on Adhesion in the Extrusion Coating Process **Gary Cheney, Michael Benson, and David A. Markgraf** / 649
18-2	A Model of Polymer Melt Flow in Spiral Mandrel Dies **Harry Mavridis** / 657
18-3	Rheological Characterization of PP Based Extrusion Coating Resins **Chun Lee, Ramesh Shroff, and Mani Shanker** / 667
19-1	How Marketing Conditions are Changing Machine Builders Direction **Jan Ivey** / 677

CONTENTS

Session Number	Title Author(s)
19-2	Bare Roll Treaters vs. Covered Roll Treaters: Make the Right Choice **Dave A. Lawson and Stuart Greig** / 681
19-3	What is Turn-Key Installation? **William A. Ditzer** / 695
19-4	A Comparison of Grooved Feed vs. Smooth Bore Extrusion on LLDPE Film Properties and Film Quality **George Panagopoulos, Jr.** / 703

Unique New Co-Polyesters for Flexible Films and Coatings

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Texas Eastman Division
EASTMAN Chemical Company
Longview, Texas 75607

ABSTRACT

Polyesters are commonly used in packaging applications requiring good gas barrier, grease resistance, and/or elevated temperature resistance. They are also known for their excellent organoleptic properties, clarity, and stiffness. Now, a new family of co-polyesters with a very different set of properties has been developed. Softness, high moisture breathability, and biodegradability characterize these materials. This paper will compare the properties of two of these developmental materials – a biodegradable grade and a moisture-breathable grade - to those of two common types of polyethylenes.

BACKGROUND

Polyester plastics are widely used in the flexible packaging industry. PET films are commonly coated or laminated into structures to add strength and/or barrier properties. One of the largest uses of polyesters is blow-molded bottles, such as those used for two liter and various smaller sized containers for soft drinks and water. Polyester is ideal for such applications because of its excellent barrier and organoleptic properties, clarity and strength. In addition, polyesters are one of the most readily recycled plastics on the market today. However, as with most plastics, polyesters are not noted for their ability to biodegrade. Recognizing the desire for a truly biodegradable plastic, Eastman began work to develop biodegradable polyester in the mid-eighties. This research led to the development of several new materials, which have some unexpected properties in terms of softness, impact resistance, and biodegradability. The purpose of this presentation is to review the properties of some of these new materials.

EXPERIMENTAL

The data for this paper was developed on pilot scale laboratory equipment, making 1-mil films by a blown film process. Cast film samples have also been prepared, but are not discussed in this paper. In either case, addition of anti-blocking additives has been used to overcome a tendency to block during rewind. Similarly, some grades have been extrusion coated, but work to develop a commercially suitable extrusion-coating grade was still in progress at the time of this writing. The blown film samples were produced at an extruder temperature of ~300^{o}F, die temperature of ~275^{o}F, and a blow-up ratio of ~3.0. Films made using standard blown film grades of low and linear low (C_4 type) density polyethylenes were used for comparative testing. The copolyesters were dried at 150^{o}F for 4-5 hrs, prior to processing. Physical testing was done according to standard ASTM methods, as indicated in the table and figures.

RESULTS

Pellet properties of two developmental copolyesters are compared to polyethylenes in Table 1. Copolyester 14766 is a biodegradable grade and copolyester 19508 is a high moisture breathability grade.

Table 1. Physical Properties

Property	Units	ASTM Method	#14766 Bio-Degradable	#19508 High-Breathability	Autoclave LDPE	Butene LLDPE
Melt Index	dg/min	D1238	30	20	2.5	1.0
Density	g/cc	D792	1.27	1.3	0.921	0.920
T_m	°C	D3418	112	112	110	115

Note that these new copolyesters have higher melt flow rates and higher densities, compared to polyethylenes. However, unlike most polyesters, their melting points are similar to polyethylenes. This combination of properties leads to lower suggested processing temperatures.

Film Physical Properties of these materials are illustrated in Figures 1 through 4. The soft feel and flexibility of these materials are evident from the secant modulus results illustrated in Figure 1, showing they have moduli even lower than a low density polyethylene. Figure 2 illustrates the excellent impact properties of these new materials. Although these materials are not highly crystalline, significant orientation effects are possible, as demonstrated by the effects of blow-up ratio in Figures 3 and 4.

Barrier Properties, in terms of water vapor transmission rates (WVTR) and oxygen transmission rates (OTR), are illustrated in Figures 5 and 6. Figure 5 illustrates the high WVTR rates that are characteristic of these copolyesters, while Figure 6 shows their oxygen barrier properties are more typical of traditional polyester materials. This unique combination of barrier properties makes thess polymers interesting for consideration in applications such as certain fresh food packaging and disposable personal comfort applications.

The biodegradable aspect of these materials is shown in Figure 7. This testing was conducted using a C_{14} radio-labeled sample of the copolyester, and monitoring the amount of C_{14} containing carbon dioxide released 50°C during exposure to an initially fresh compost (an in-house method, submitted to ASTM for balloting as an accurate means of measuring true polymer breakdown). With this method, the material is considered to be near complete reduction to CO_2, water, and biomass, when the percent conversion to CO_2 has reached 70%. Thus, this new copolyester has biodegraded in about six months. For comparison, a 1995 article in the Journal of Applied Polymer Science (Ref. 1) showed some signs of minor biodegradation of polyethylene, but only after exposure to soil for *32 years*.

Conclusions

The polymers discussed in this paper have a combination of properties unlike those commonly associated with polyesters. The combination of softness, impact, and high moisture breathability make these copolyesters interesting candidates for various packaging and personal comfort applications.

REFERENCES

1. Y. Oake, T. Kobayashi, H. Asabe, and N. Murakami, *J. Applied Polymer Science,* **56,** 1789 (1995)

Figure 1 - 1% Secant Modulus
(ASTM D-882)

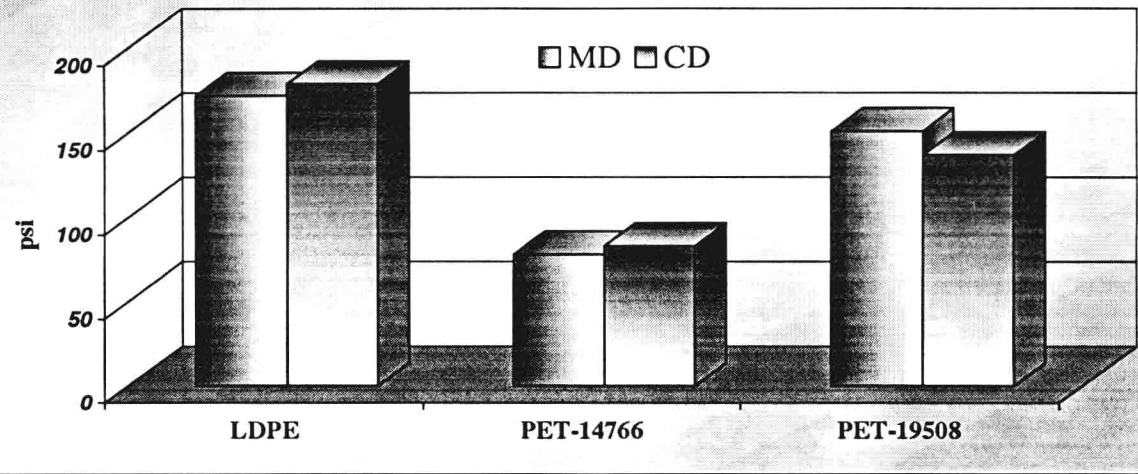


Figure 2 - Dart Impact
(ASTM D-1709)

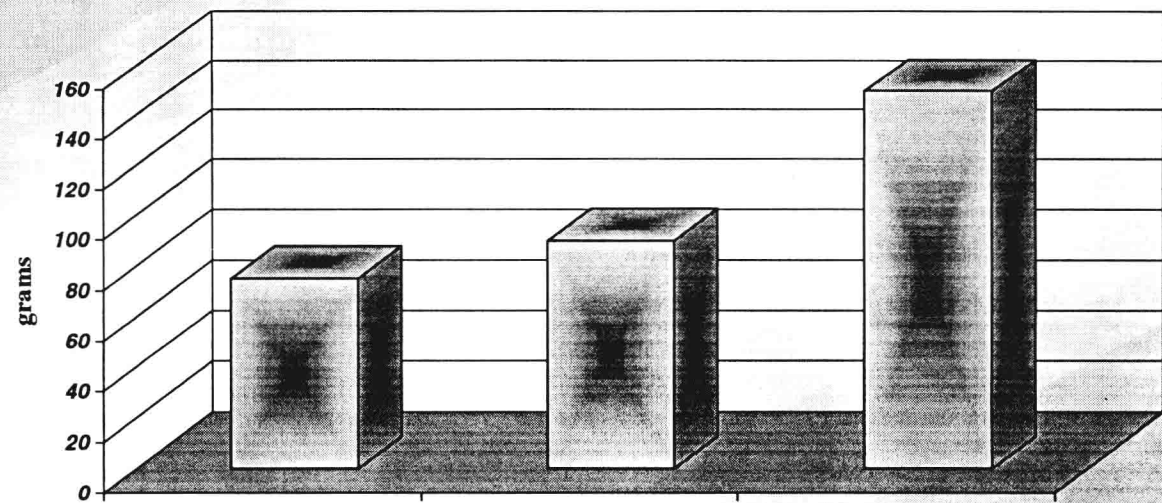


Figure 3 - Tensile Strength -vs- Blow-Up Ratio

(ASTM D-882, Machine Direction))

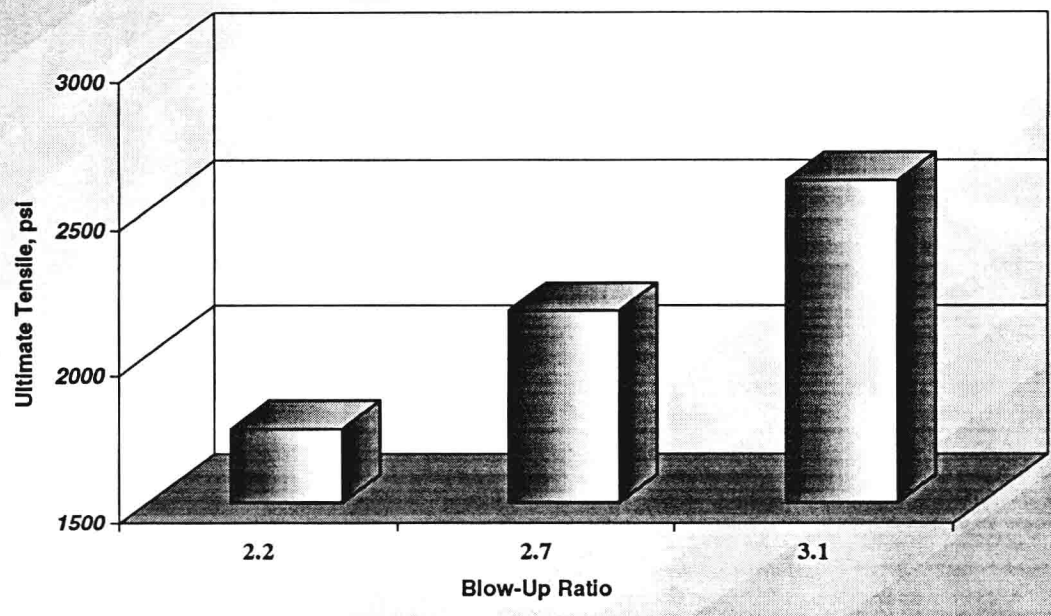


Figure 4 - Elmendorf Tear

(ASTM D-882 - Machine DIrection)

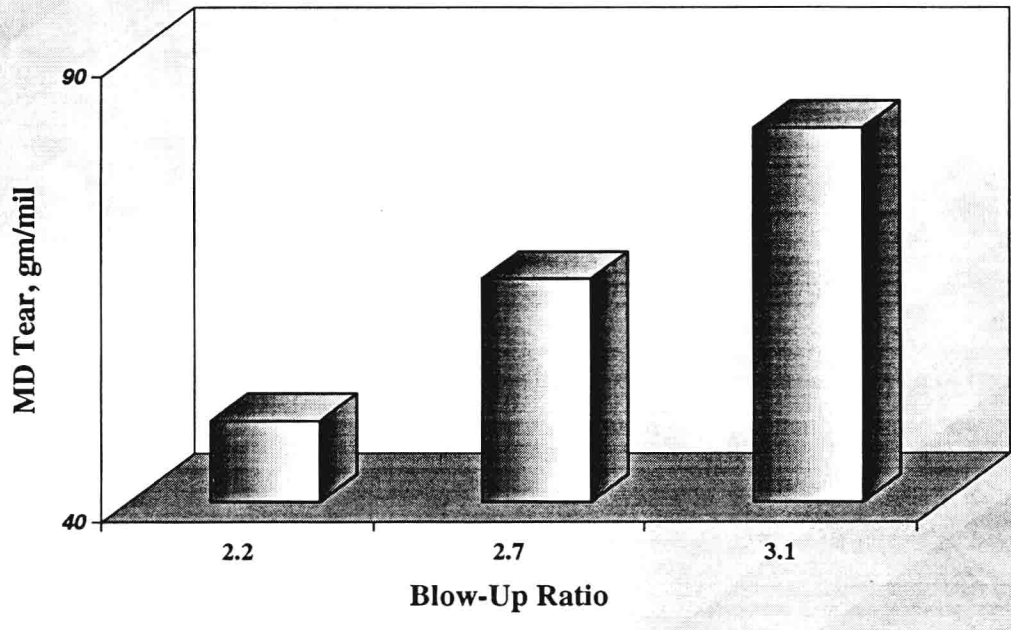


Figure 5 - Moisture Vapor Transmission Rates
(Mixed Methods)

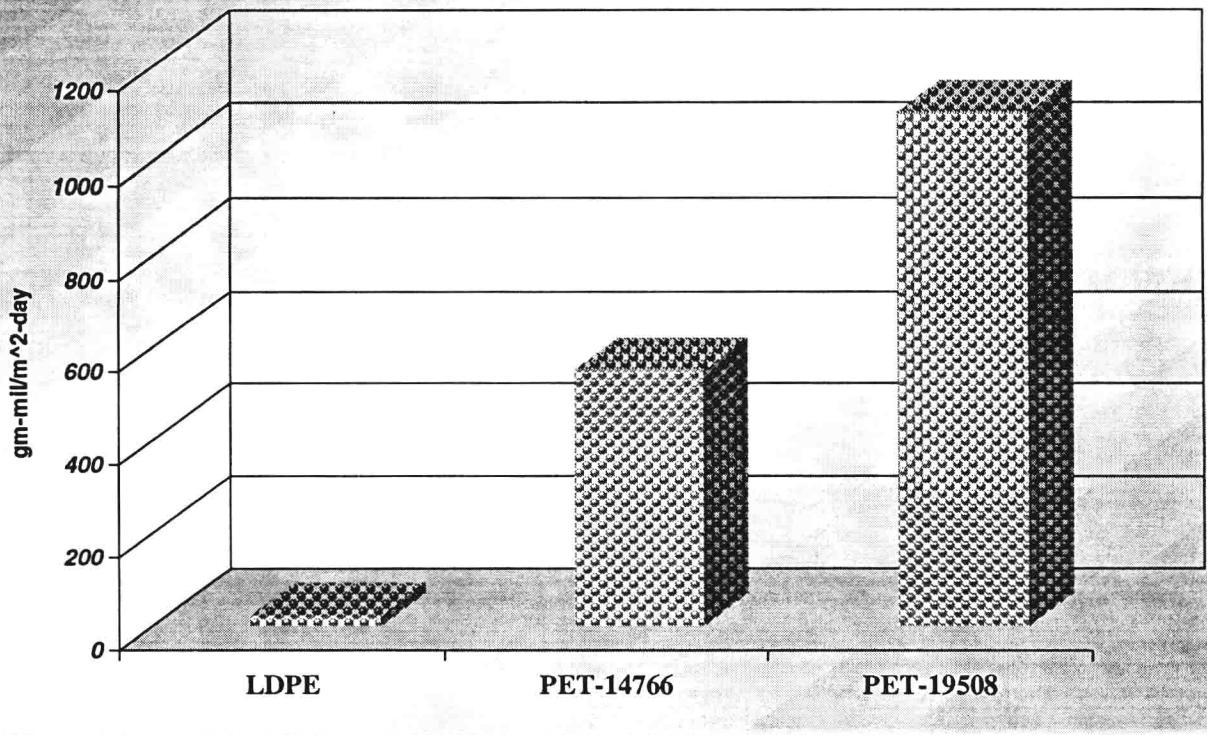


Figure 6 - Oxygen Transmission Rates
(ASTM D1434)

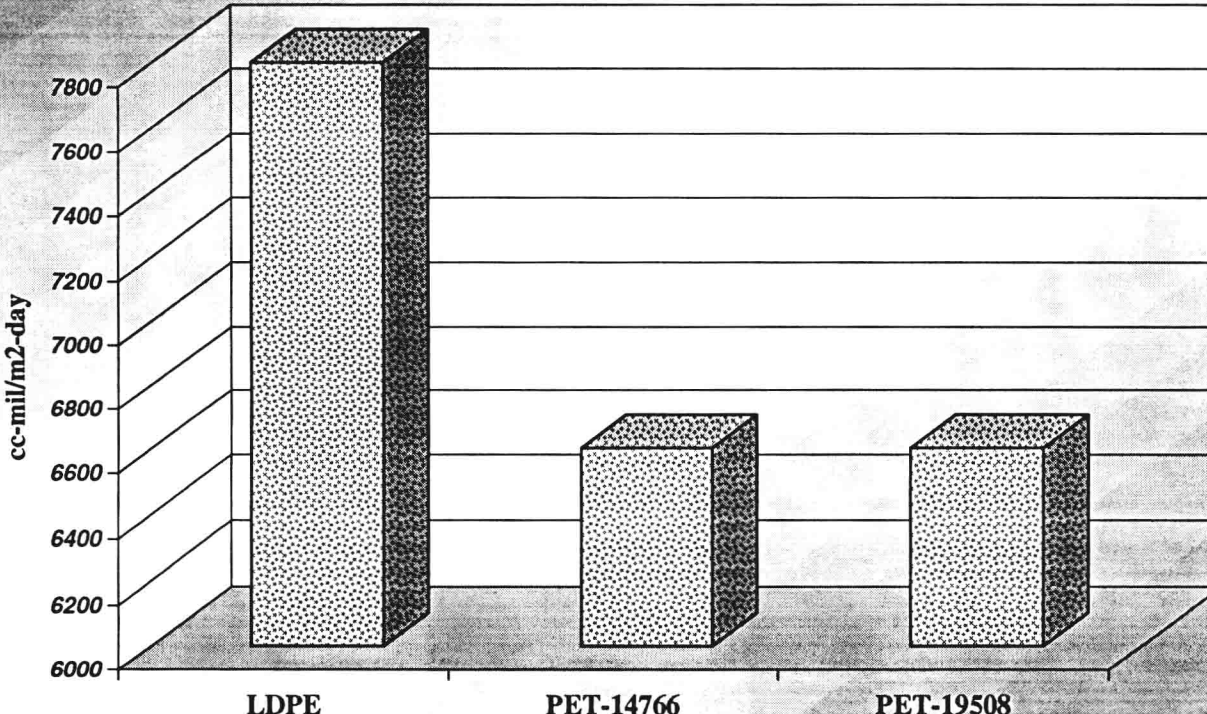
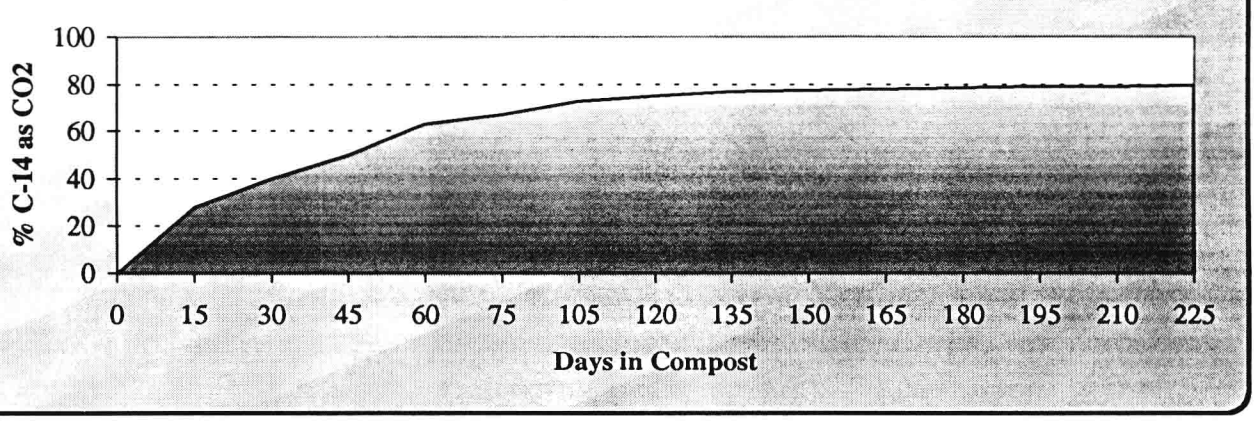


Figure 7 - Biodegradation Study

(EASTMAN C-14 Labeling Method)



GUIDE TO NYLON CHEMISTRY, EQUIPMENT & PROCESSING (Coating and Casting)

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Germany

Keywords
PA-, PA-66, Homopolymers, Copolymers, Polyoiefines, Morphology, Rheology, Viscosity, Melt properties, Adhesion, Structures, Packaging, Marketing, Trends, Casting, Coating, Film, Extrusion, Packaging-applications, Coextrusion, Crystallisation, Equipment, Processing, Screw design, Screens, FB, Die, Purging, Start-up, Shut-down, Air-knife, Vacuum Box, Pining, Instability, Layer distribution, Moister, Trouble-shooting, Encapsulation.

1.0.0 INTODUCTION

Packaging materials for perishable food products, like meats and sausages, ham and cheese products, must meet many requirements. They have to provide a gas and aroma barrier, moisture retention to prevent desiccation of the contents, oil and grease resistance, taste neutrality, optical properties like transparency and gloss, printability and ease of labelling, mechanical properties such as toughness and flex strength, thermoformability and sealability, ease for processing at high rates on modern packaging machinery, product presentation with high sales appeal, durability and freshness for the end users, as well as easy, non-polluting disposal after use.

So many requirements can hardly be met by one material alone; however, by the combination of several materials with complementary properties, it is possible to produce packaging materials with an optimum price/performance ratio.

Multilayer structures made from PA in combination with polyoiefines and papers, foils and kindred products, meet the relevant requirements for food packaging in an ideal way. In addition to the film characteristic, the processing efficiency, recyclability (edges and product), downgauging and price are in consideration for selected resin. Common resins utilised in film applications are: a small family of resins such as EVOH, PVDC, PA, PET provide the flavour and gas barrier properties required .

Very important characteristic for PA resin family is downgauging through coextrusion cast process or by orientation-mono and biorientation-of the PA film itself or with PA/EVOH/PA structures. As flexible packaging is expanding more due to source reduction, PA film coextruded and extrusion coated-laminated structures start to be more important than in previous period of development. Because of this balance of properties that PA is in use more than any other resin for the production of film for the food and medical packaging market.

Polyamide family of resins combines the ease of processing (only with proper extrusion equipment and knowledge) and mechanical strength to yield an efficient product. Also possibility to combine PA family of resins with other material are technologies of sophistication. More understanding of usability and processability of PA and (co)extrusion are subject of this paper

2.0.0 BUSINESS HISTORY

The first nylon product was sold in 1938 and was a continuous, large-diameter filament used as a bristle for toothbrushes. Textile machinery gears were made by DuPont for its own use in 1939.

The consumption of nylon plastics in three large areas of use (the United States, Western Europe, and Japan) exceeded 830 kilotons (1.83 billion pounds) in 1992. A breakdown of the market areas for the United States and Western Europe between 1982 and 1992 is shown in Table 4. Injection molding markets averaged about 3.0 and 2.1 times those of extrusion in, respectively, Western Europe and the United States. A broad spectrum of applications is indicated; the transportation and electrical/electronic markets were, in order, the first and second largest in both regions.

The growth of nylon plastics is roughly similar to that of all plastics in spite of the introduction or growth of commodity plastics such as polyvinyl chloride, polystyrene, polyethylene, and polypropylene and of new engineering resins. In fact, the data indicate an increase in nylon plastics as a percentage of all plastics by about double, from about 0.5% to 1.05%, over that 43-year period. The rapid growth of reinforced nylons from 1966 into the 1980s is clear; its growth has since slowed and has more nearly paralleled that of all nylons.

The per capita consumption of nylon plastics in 1992 was approximately 1.1 kg (2.4 pounds) in Europe and almost 1.3 kg (2.9 pounds) in Japan. The dominant nylon plastic is PA-66 in the United States and PA-6 in Europe and Japan.

Total PA consumption in Western Europe was approx. 380.000 t in 1994, with roughly 50.000 t. being used for PA film, or 150.000 t PA/PE structures. Forecast of 5%- 7% p.a. increase for PA being used by converting industry is realistic. Similar numbers and forecast are applied for North American market. For Far East market forecast is 10-12% growth of PA use for film production.

A closer look at the utilisation methods of this market segment shows two important points.

3.0.0 MARKET & APPLICATIONS

Nylon applications are found in virtually every industry and market. Typical are nonlubricated gears, bearings, and anti-friction parts; mechanical parts incorporating snap fits, detests, or spring loading; painted auto body parts; electrical parts subject to elevated temperatures; mechanical parts that must function at elevated temperatures and resist hydrocarbons and solvents; mechanical parts requiring strength in thin sections; high-impact parts requiring strength and rigidity; monofilament for fishing line; string trimmers; and film for food contact.

3.1.0 Electrical/electronic uses include card guides, connectors, terminal blocks, wire ties, receptacle plugs and covers, building wire jacket, hookup wire, antenna mounts and brackets, and coil bobbins.

3.2.0 Consumer applications include bicycle wheels, ice skate supports, caster wheels, hairbrushes and combs, power tool housings and handles, chain saws, and monofilament weed trimmer whip.

3.3.0 Automotive applications include speedometer and windshield wiper gears, wire harness clips and fasteners, connectors, emission canisters, fluid reservoirs, dipsticks, engine fans and shrouds, air cleaner housings, fuel system components, cowl vents and painted exterior body parts, lamp assemblies, mirror housings, wheel hubs, and door and window hardware.

3.4.0 Packaging applications include bags for conventional and microwave cooking, film for low oxygen-permeability food wraps, sausage casing, and frozen food pouches.

Nylons, or polyamides, are melt-processable thermoplastics whose chain structure features repeating amide groups. As engineering thermoplastics, they offer a combination of properties, including high strength (especially at elevated temperatures), toughness at low temperatures, stiffness, wear and abrasion resistance, low coefficient of friction, and good chemical resistance.

First, the Western European Market is dominated by multilayer construction by a ratio of almost 20:1 and second cast films is the preferred processing method by a ratio of almost 3:1.

Extrusion coating with PA to different substrates in Europe is in slight progress, mainly as single layer, estimated amount of PA used for coating is relatively small about 3.000t.

Tendency from USA to produce multylayer coating of PA/PE or PA/Surlyn or PA/TPX and similar is driven by tendency to substitute Al-foil as barrier from liquid packaging and ovenable packaging is increasing .

Tendency to coat- coextrusion- PA film, or PA/EVOH/PA with polyolefines oriented or not-oriented is increasing in case of oriented films (mono- and bi-oriented). Only cast PA- films, extrusion coated are substituted with coextrusion-cas processes .

4.0.0 PACKAGING APPLICATIONS

4.1.0 Fresh Meat

DESCRIPTION

Primary cuts of beef, pork, lamb, veal. Read Meats are typically package as:

Primal cuts
- Large Cuts (15-50 kg)
- Barrier shrink bag
- used for transport from the slaughterhouse to the butcher

Sub Primal Cuts
- Further processed at the slaughterhouse (deboning, cleaning, trimming, slicing)
- Barrier shrink bags used

Consumer Cuts
- Case- ready packs are retail size cuts displayed in retail outlets
- Prepared from primal and sub-primal cuts by in store butcher

TYPICAL STRUCTURES
- PS- trays + PVC film overwrap
- Barrier shrink bags
- Vacuum pack and map

PERFORMANCE REQUIREMENTS

Barrier shrink bags for primal cuts, sub-primal cuts demand the same performance characteristics
- Oxygen barrier (S.L. 30-45 days)
- Toughness
  Sealing through grease
- Low cost
- Water vapour barrier resistance
- Visibility
- Seal strength
- Moisture resistance
- Good shrink characteristics