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BFGOODRICH CHEMICAL LIMITED

ALTONA

TECHNICAL SERVICE LABORATORY

REPORT

FOR

PRODUCT DEVELOPMENT DEPARTMENT

EXTRACTION OF BISPHENOL A FROM FINISHED PVC PRODUCTS

Project No: 6980-2

By: Greg Brown

Date: 20th October, 1980

21104021

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BROADBENT CHEMICAL LIMITED

ALFONA

PROJECT NO: 6980-2

DATE: 20th October, 1980

EXTRACTION OF BISPHENOL A FROM FINISHED PVC PRODUCTS

INTRODUCTION

This work was initiated as an extension of Project No. 6980-1 in order to gain approval for the use of Bisphenol A (BPA) as a shortstop in the production of Poly (vinyl chloride) (PVC).

Having determined the level of residual BPA in PVC resin, it was necessary to determine its extractability from food contact products.

CONCLUSION

The work showed that aqueous solvents did not extract a detectable amount of the BPA from the finished product.

Fatty type solvent, heptane, extracted 17 μg /square inch.

Results are shown in Appendix II.

EXPERIMENTAL

1. Introduction

As there is no Australian Standard covering the presences of BPA in plastics used for food contact applications, the development of the extraction procedures was based on the American FDA method No 175-300, pages 505-510.

Two formulations were tested, one representing rigid food packaging (E) such as bottles and the other (G) representing flexible food wrapping such as film. They were prepared using the resin which had been shortstopped in a plant trial, and were known to contain 62 ppm of residual BPA. These formulations are shown in Appendix I.

Each formulation was fluxed on a steam heated laboratory two roll mill. Plaques 15cm x 15cm x 0.125cm were prepared on a steam heated press. Small samples, 4cm x 4cm x 0.125cm, were then cut for the extraction tests.

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These data are based on tests which are believed to be reliable. They are information only as we cannot accept responsibility for processes not under our direct control.

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The British Plastics Federation

Registered Office 5 Belgrave Square London SW1X 8PH
A company limited by guarantee Registered in England No 282883

Telephone 01-235 9483
Telegrams Plased London SW1
Telex 6951528 Plased G

4th December 1980

B. La Fontaine Esq.,
National Divisions Manager,
The Plastics Institute of Australia Inc.,
157 Fitzroy Street,
St. Kilda,
Vic. 3182,
Australia.

Dear Barry,

Dr. Holmes-Walker has passed your letter of 21st November to me
for attention.

According to our Code of Practice for Plastics in Food Contact
Applications, which we publish in cooperation with the British
Industrial Biological Research Association, BISPENOL A is considered
a safe additive for use in such applications. It is actually
identified as an additive for polyesters (with a maximum level of
70% W/W of final compound) suitable for use in contact with all
food products.

I trust this information may be of help to you.

Yours sincerely,

C.C. Parkhouse
Assistant Director
Head of Technical Division

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A P P E N D I X

UNION CARBIDE LITERATURE

ON BISPHENOL A (F40900B)

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APPENDIX VIII

COPY OF THE LETTER FROM

UNION CARBIDE (AUSTRALIA)

RE PURITY OF BPA

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UNION CARBIDE AUSTRALIA LIMITED

INCORPORATED IN NEW SOUTH WALES

505 ST. KILDA ROAD, MELBOURNE, VICTORIA, 3000. AUSTRALIA

G.P.O. BOX 1227L, VIC. 3001 • TELEGRAMS: "UNICARBIDE" MELBOURNE • TELEPHONES: 26-1241, 26-2332

1st March, 1978

Mr. Vincent J. Scully
Technical Service Manager
B.F. Goodrich Chemical Limited
ALTONA, VIC.

Dear Mr. Scully,

Re: PRODUCTS FOR USE AS ANTIOXIDANTS
IN PVC UNDER AUSTRALIAN STANDARD 207C

We advise that chemicals supplied by UCAL are manufactured to Internationally Accepted Standards of quality and are free from impurities likely to have an injurious effect on health.

Applies to:

- Ethyl Acrylate
- Potassium Persulfate
- Bis Phenol A.

To assist in preparation of a case for the last named chemical we enclose a Union Carbide brochure on the product.

Yours faithfully,

UNION CARBIDE AUSTRALIA LIMITED

W.L. Routley
W.L. ROUTLEY
Commercial Development Manager

WLR/eb

Enc: brochure

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A P P E N D I X I X

UNION CARBIDE LITERATURE

"UCAR^(R) BISPHENOL A APPLICATIONS"

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Application Areas

1. Textiles

Acrylics

Application of the mixture that results from heating Bisphenol A and furfuryl alcohol to polyacrylonitrile fibers speeds dyeing and development of deeper shades from direct or acid dyes⁽¹⁾.

Cellulosics

Studies on the sorption and affinity of Bisphenol A on cellulosics⁽²⁾, especially cotton⁽³⁾, led to the conclusion that it can be used as the coupling component in cold dyeing.

A report that Bisphenol A is useful for improving the crease recovery properties and dimensional stability of cotton and viscose rayon fabrics has appeared⁽⁴⁾.

Polyesters

Bisphenol A is useful for the solvent bonding of polyester-derived nonwoven fabrics⁽⁵⁾.

High temperature dyeing of "Dacron" fabric with disperse azo dyes based on Bisphenol A coupled with diazonium compounds is possible⁽⁶⁾.

Nylon

Metal complexes (copper, nickel, chromium) of the product obtained from coupling Bisphenol A with diazotized anthranilic acid are useful dyes for nylon⁽⁷⁾.

Aqueous emulsions of Bisphenol A are useful for the solvent bonding of Nylon 66 fibers to produce nonwoven fabrics⁽⁸⁾.

Impregnation of twisted, nylon multifilament yarns with 4-12 per cent methanolic Bisphenol A solutions, followed by heating at 150°C. for 10-20 seconds produces threads that are suitable for high speed sewing machines⁽⁸⁾. Bisphenol A-containing adhesives for nylons are described in the next section.

Polyurethane Elastomeric Fibers (Spandex)

A stabilizer package containing Bisphenol A imparted excellent heat, light, and chlorine bleach stability to polyurethane type elastomeric fibers⁽⁹⁾. Bisphenol A (0.3%) combined with piperidino sulfides (e.g., 2,2,6,6-tetramethylpiperidino disulfide - 0.3%) is one such combination.

Wool

Metal complexes (copper, nickel, chromium) of the product obtained from coupling Bisphenol A with diazotized anthranilic acid are useful dyes for wool⁽⁷⁾.

General

Emulsions containing Bisphenol A in addition to other ingredients

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facilitated the shaping of textiles made from either natural or synthetic fibers⁽¹⁰⁾.

Cold dyeing with Bisphenol A-coupled diazo compounds yields products with good wet fastness⁽¹¹⁾. Use of Bisphenol A in conjunction with C_{16} - C_{18} fatty acids and monoethanolamine stearate facilitated the granulation of finely divided pigments, dyes, and filler materials⁽¹²⁾.

2. Adhesives

UCAR Bisphenol A complies with FDA regulations for use as a component of adhesives used in food packaging⁽¹³⁾.

Adhesives for pretreated steel based on polyvinyl chloride formulations that incorporate 1.5 parts of Bisphenol A and 4.5 parts of hexamethylene-tetramine have been described⁽¹⁴⁾.

Fusible adhesives for plasticized poly(vinyl chloride) contain 10-30 parts of Bisphenol A and 70-90 parts of polyamides derived from fatty acids⁽¹⁵⁾.

Several reports describe the utility of Bisphenol A for bonding textile fibers and fabrics, especially nylons. Acetone solutions of Bisphenol A are useful for bonding Nylon 6 and other polyamides⁽¹⁶⁾. Blends of polyamides (Nylon 6 and 66) with Bisphenol A and octyl *p*-hydroxybenzoate are effective adhesives for nylons, polyesters, and cotton fibers⁽¹⁷⁾. They excel in their laundering and dry-cleaning resistance. Peel strengths of nylon laminates with polyester/cotton mixed fabrics were markedly enhanced when up to 20 per cent of Bisphenol A was incorporated into the nylon filament⁽¹⁸⁾.

3. Thermographic Recording Materials

Bisphenol A finds utility as an ingredient in thermographic or heat developable recording and reproducing materials. One report uses the adduct of Bisphenol A with isopropylamine in a heat sensitive recording layer material⁽¹⁹⁾. It undergoes a color change at 154-7°C.

Several other reports describe the use of a color-forming reaction between crystal violet and Bisphenol A^(20,21,22). Paper is coated with poly(vinyl alcohol) containing particles of crystal violet lactone and Bisphenol A. On heating, color forms where the Bisphenol A melts.

4. Photographic Antifoggant

Photographic silver halide emulsions are stabilized by the addition of Bisphenol A against fog⁽²³⁾. When part of the gelatin has been replaced by a poly(N-vinyl lactam), 5-50 millimoles Bisphenol A/mole of silver halide is recommended⁽²⁴⁾. Similarly, 4.7-30 millimoles Bisphenol A/mole of silver halide are used to prevent fogging by non-optical sensitizers containing polyoxyalkylene groups⁽²⁵⁾.

5. Electroplating

The addition of Bisphenol A to a chromium electroplating bath at a concentration of ≥ 0.006 g./l. suppresses the atmospheric entrainment of liquid particles of inorganic salt solution⁽²⁶⁾. This entrainment, which is due to H_2 and O_2 bubbles liberated at the cathode can be reduced by up to 95-100 per cent.

Tin plating bath solutions containing 2 g./liter of Bisphenol A are much improved with respect to loss of tin by oxidation of stannous to stannic sulfates. The latter is deleterious because it hydrolyzes to stannic oxide which precipitates, thereby causing a deterioration in the quality of the tin plate⁽²⁷⁾.

6. Battery Electrolyte

The addition of 0.05 per cent of Bisphenol A to a battery electrolyte is reported to improve the storage life of the batteries prepared therefrom⁽²⁸⁾. Capacity and discharge voltage were not impaired.

7. Leather Tanning

Tanning and dispersing agents containing Bisphenol A are reported to yield leathers possessing good light fastness⁽²⁹⁾. Bisphenol A can also be used for chrome post-tanning, and it can act as a fixative for pigments in textiles.

8. Sand Mold Binder

Binders for sand molds based on Bisphenol A possessed improved properties⁽³⁰⁾. A typical recipe mixed 100 parts of Bisphenol A and 15 parts of hexamethylenetetramine with the sand followed by a heat cure.

9. Lacquer Peptization

A procedure for the peptization of gelled lacquer or resin solutions employs 20 per cent Bisphenol A solutions in butanol or toluene⁽³¹⁾. This can be effected by heating and stirring the gelled lacquer at 60°C. with 5-10 per cent of Bisphenol A solution.

10. Drilling Muds

Bisphenol A effectively preserves the emulsion stabilizing effect of lecithin when it is used in dry concentrates for invert emulsion well fluids. It was one of the 5 best compounds of the 31 that were tested. It was used at a concentration of 0.1-20 per cent by weight based on the lecithin weight⁽³²⁾.

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