10/59

ORGANIC DEVELOPMENT TECHNICAL BULLETIN

FLAME - RETARDANT POLYETHYLENE

Aroclor obsolete

DEVELOPMENT DEPARTMENT
MONSANTO CHEMICAL COMPANY

ORGANIC CHEMICALS DIVISION
ST. LOUIS 24, MISSOURI

TO ASSIST YOU IN THE EVALUATION OF THE ABOVE PRODUCT, WE HAVE OBTAINED THE INFORMATION CONTAINED IN THIS BULLETIN FROM LITERATURE SOURCES AND PRELIMINARY INVESTIGATION IN OUR OWN LABORATORIES. WHILE WE BELIEVE THE INFORMATION IS ACCURATE, WE ASSUME NO RESPONSIBILITY AND DISCLAIM ANY LIABILITY INCURRED IN USING THESE DATA OR SUGGESTIONS. ONLY QUALIFIED TECHNICAL PERSONNEL SHOULD WORK WITH THIS PRODUCT UNTIL SUBSEQUENT STUDIES JUSTIFY ITS USE IN YOUR PRODUCTS OR PROCESSES. OBVIOUSLY NOTHING IN THIS BULLETIN SHOULD BE CONSTRUED AS A RECOMMENDATION TO USE ANY PRODUCT IN CONFLICT WITH EXISTING PATENTS COVERING ANY MATERIAL OR ITS USE.

With the recent requirements for flame retardant plastics, defined by the Underwriter Laboratories, interest in producing satisfactory compounds for appliance applications has substantially increased.

This technical bulletin presents data on Aroclor Modified-Flame Retardant Polyethylene. It compares the polyethylene, modified with Aroclor 5460, to polyethylene containing similar amounts of a 70% chlorinated paraffin.

Aroclor 5460 will produce flame retardant polyethylene added per se at 30% by weight or at 20% by weight in combination with 10% Antimony Oxide. These additions improve Melt Index, slightly reduce % Memory, retain Tensile Properties and reduce compound costs.

At equivalent concentrations, the effect on the physical properties by Aroclor 5460 are significantly less pronounced than the 70% chlorinated paraffin. Heat stabilities of the Aroclor systems are significantly better than the paraffin modified polyethylene.

Aroclor 5460 is a 60% chlorinated terphenyl. It is commercially available at the following prices:

*Carload or Truckload	18.25¢/lb.
*LCL or LTL	19.25¢/lb.
5-gallon container	24.25¢/lb.

All prices F.O.B. - Anniston, Alabama
*Packed in 500 fibre drums.

Samples of Aroclor 5460 are readily available ..... standard sample size is one pound.

0221532

TOWOLDMON0026174

Following in Table I below are comparative test results on combinations of polyethylene with Aroclor 5460, a 70% chlorinated paraffin and Antimony Oxide.

The Melt Index and % Memory values were determined using condition E of ASTM 1238-57T except that in all cases 9 grams of material were charged into the cylinder. Tensile properties were determined on miniature specimens with the Instron at a jaw speed of 10 inches a minute.

The burning tests were conducted as follows:

> Strips of polyethylene, 1" x 4" with lines scribed ½" from each end, are hung in an asbestos cylinder 2½" in diameter and 5" in length. A bunsen flame, 1" high, is used to ignite the specimen. When the flame reaches the first scribed mark, the flame is removed and a stopwatch started. The time to flame out or to the second scribed mark is measured.

Note (in Table I, next page) that the 30% modification by Aroclor 5460 has tensile properties superior to the 20% modification by the chlorinated paraffin. This reduced effect on tensiles at the higher modification is also true when 10% Antimony Oxide is added.

TOWOLDMON0026175

TABLE I

Properties of Low Density Polyethylene Modified with Aroclor 5460 and a 70% Chlorinated Paraffin

	Melt Index	% Memory	%Elongation	Tensile	Yield	Burn Rate	Self-Extinguishing
Control	1.96	57.2	655	2130	1395	7.1 in/min.	No
80% polyethylene 20% Chlor. Para.	5.9	61.5	585	1640	1450	0	Yes
70% polyethylene 30% Aroclor	11.2	51.5	647	1850	1320	0	Yes
70% polyethylene 30% Chlor. Para.	10.5	67.2	130	1175	1195	0	Yes
80% polyethylene 10% Chlor. Para.,10% Antimony Oxide	3.6	59.0	655	1905	1445	0	Yes
70% polyethylene 20% Aroclor 10% Antimony Oxide	6.2	52	650	1710	1300	0	Yes
70% polyethylene 20% Chlor. Para., 10% Antimony Oxide	6.4	54	540	1200	1320	0	Yes

TOWOLDMON0026176

In Table II the heat stabilities of variously modified polyethylene are compared. Note the significant improvement in heat stability when the Aroclor 5460 is the modifying agent. These values are important to the molder where the modified polyethylene may be held at high temperatures for an extended period of time.

TABLE II

Heat Stability of Modified Polyethylene
(Air circulating over at 190°C)

Time (Min.)	0	10	20	40	60
Control	white	off-wh.	off-wh.	off-wh.	sl.yel.
80% polyethylene 20% Chlor.Para.	yl.-tan	dk.tan	lt.brn.	brown	dk.brn.
70% polyethylene 30% Aroclor 5460	lt.yel.	lt.yel.	lt.yel.	lt.yel.	mod.yel.
70% polyethylene 30% Chlor.Para.	dk.tan	lt.brn.	brown	dk.brn.	black
80% polyethylene 10% Chlor.Para., 10% Antimony Oxide	white	white	lt.tan	tan	dk.tan
70% polyethylene 20% Aroclor 5460 10% Antimony Oxide	white	white	white	off-wh.	lt.yel.
70% polyethylene 20% Chlor.Para. 10% Antimony Oxide	wh.-tan	lt.tan	tan	dk.tan	lt.brn

TOWOLDMON0026177

Following in Table III are the general physical properties of Aroclor 5460.

TABLE III

AROCLOR 5460 - PHYSICAL PROPERTIES

Form	Yellow transparent resin
Color	2.0 NPA
Acidity	0.07 (mgm KOH per gram)
Specific Gravity 25/25°C.	1.670
Pounds per gallon	13.91
Flash Point*	None
Fire Point*	None
Softening Point	100° - 105.5°C.

* Cleveland Open Cup

RMP/se - 300
10/26/59

0221536

TOWOLDMON0026178