General Chemical

M-2

Technical Director
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June 15, 1966

SOCIETY OF THE PLASTICS INDUSTRY
1966 ANNUAL CONFERENCE

1. The writer attended subject meeting to audit conferences on use of plastics, particularly the two symposia on Plastics in Packaging; another group of papers on Plastics in Agriculture was also attended. Reviews of these sessions are attached.

2. It is quite obvious that all areas of the plastics industry are growing rapidly and have a promising future for some years to come. Whereas all manufacturing is expected to grow at an average annual rate of 4.7% for the next ten years, plastics growth is expected to average 15.1%. The dollar value of plastics in packaging is expected to double by 1970 to about $1.8 billion; films are the largest single outlet.

3. The paper of greatest interest - "FDA Status of PVC Compounds" - added little to the writer's knowledge in this area; it did indicate that presently available stabilizers acceptable to FDA are adequate for present purposes (processing temperatures of 340-350°F) and will preserve physical characteristics of PVC for brief time at 400°F. Discoloration is not prevented at this temperature. No guess could be made on date of promulgation of FDA regulation permitting dialkyl tin stabilizers.

4. From the point of view of the writer all papers were well presented in that uses were well covered and good attempts made to estimate present and future markets.

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BFG61362

ASI 00000085

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REVIEW OF SYMPOSIA

Plastics in Agriculture

Dr. Fay[illegible] Sheldrake, Jr. of Cornell University described several uses of plastics in the growing of truck crops, particularly mulching, row covers and construction of plastic greenhouses. In first use [illegible] tomatoes, strawberries and melons are grown with plants piercing plastic sheets, usually 3 to 4 feet wide. Sheets are alternated with open ground for irrigation. If clear plastic is used surface ground temperature runs 6-10 °F higher than normal; [illegible] black plastic there is no rise in temperature. However, the real difference is due not to temperature but to CO_2 concentration under the plastic averaging 1300 ppm vs. 330 ppm for uncovered ground. Yield in the case of melons is about 3 times normal; with tomatoes [illegible] yield is up to 25 lbs. per plant or 150,000 lbs. per acre. Procedure is well established for strawberries and melons, and Dr. Sheldrake believes it will be economical for tomatoes.

A second major use is the construction of plastic greenhouses. [illegible] - mil fill construction lasts for 1 crop year. Dr. Sheldrake recommends double layer of plastic separated by 2" x 2" strip with inside layer UV resistant so that it will last for two years. His greenhouses are designed for 16' plastic rolls which is maximum width presently available. Another development is the use of rigid vinyl (PVC) sheets now imported from Japan as building panels. Cost is much higher (est. $0.12/ft.^{2} vs. 0.01¼/ft.^{2} for polyethylene, but expected life is 5-6 years. Using polyethylene Dr. Sheldrake estimates cost of 21' x 100' double layer greenhouse at $[illegible]. Consumption of plastic film in agriculture is roughly estimated at 40 x 10^6 lbs. per year.

Dr. Charles Staff, Consultant, formerly with Carbide & Carbon, discussed use of plastic sheeting for farm viaducts and for storage ponds. Water conservation is important to the farmer and it was stated that eastern farmers might out-produce the west if irrigation were employed. In many areas plastic sheeting is used to line irrigation canals not only to save water but to prevent rotting of root structure adjacent to [illegible] too much water. Plastics most commonly used are 30 mil PVC and 32 mil butyl with the latter preferred although initial cost is higher. Dr. Staff recommended highest quality materials for best overall economy. Collection of drinking water for animals is an increasingly important use for plastic sheeting.

Plastics In Packaging

To indicate the opportunity for plastics, Mr. Mathew, Moderator of the session, stated that the packaging bill for U. S. products was of the order of $26 billion.

Mr. [redacted] Schaefer of Diamond Alkali discussed FDA status of PVC compounds. He emphasized the present change in FDA under Dr. James Goddard, the fact that FDA does not give "approvals", the prior sanction of the basic polymer, and the fact that dialkyl tins do not have acceptance by FDA. He stated that the mixed calcium-zinc salts now used impart reasonable stability at processing temperatures of 340-350°F but did not completely prevent decomposition at 400°F. He also stated that physical characteristics are not appreciably degraded at 400°F but that yellowing depreciated esthetic value. Mr. Schaefer defines flexible PVC as that containing more than 15 pts. plasticizer per 100 pts. PVC.

As solutions to the PVC stability problem he suggested PVC-PVAc copolymers with reduced processing temperature, but lower heat distortion temperature. PVC-octyl vinyl ether and PVC-polypropylene copolymers were also suggested. New processing techniques viz. high temperature for only short time may aid in PVC problem.

To the knowledge no petition on di-alkyl tin stabilizers has been submitted to FDA. The writer believes that a petition was probably submitted some time ago but, via the old FDA handling procedure, has not been accepted for filing. The loss of Mr. Earl Detwiler at FDA may seriously deter progress of a petition, if submitted.

Mr. Gilbert Miles of Colgate discussed PVC bottles from point of view of marketer. To him the container is selected for economy, esthetic effect, in-plant handling and out-plant handling. At present glass is lowest cost with polyethylene second and PVC at present a poor third ($25, $35 and $52 per thousand); however, following the history of polyethylene PVC should be competitive within a reasonable time. Mr. Miles is impressed by the opportunity of having both clarity and color in a container. He does not anticipate much difference in breakage, already apparently very low in Colgate experience. As to suitability of PVC containers, he stated that PVC

is quite acceptable for most dilute aqueous solutions but is somewhat worried about heat distortion. One shortcoming of the plastic bottle is the smaller outside dimensions of container due to thin walls; an advantage is freight saving which isn't controlling of itself but a good plus factor. Mr. Miles expects many new methods of dispensing from plastic packages.

Mr. [redacted] Weber of Shell Chemical discussed the plastic milk bottle. Progress here has been excellent in his opinion; whereas glass and coated paper shared the milk container market equally in 1961, in 1965 the market was 40% glass, 58% coated paper and 2% plastic. Plastic milk containers are now used in 2 states and over 500 dairies. Mr. Weber expects 10% of the market within a short time, equivalent to 104,000,000 lbs. [redacted] plastic. Blow molding machine output has increased from [redacted] to 1200 units per hour, resin price has gone from $0.32 to $0.20 per lb. Present price for polyethylene bottles ranges from $82-100 per 1,000 for gallon size and $75-65 per 1000 for half gallons. The gallon price is quite close to coated paper.

Twenty dairies in Washington and Oregon are experimentally using a returnable plastic container by permission of the U.S.Public Health Service. Distribution is confined to home delivery. Inspection of returns is visually and via a detection device the nature of which is undisclosed. Results of this test have not been made public.

Mr. Milton Immermann of W. D. Teague Associates discussed design considerations for plastic containers. Teague Associates are designers of the plastic "high-waist" liquid detergent bottles for P & G which have been widely imitated by others. P & G required that the three bottles have the same content, be capable of filling at the same speed as glass filling equipment and be individually distinctive. The result was three "high-waist" bottles with variations in the shoulder. Mr. Immermann obviously believes that only industrial designers like Teague can do a good job on containers; they apparently have a very well equipped laboratory to produce prototype samples so that nothing is left to imagination of their customers.

Mr. J. J. Best of American Can discussed prospects for coatings on paper, metals or other plastic substrates. To the writer the area discussed is substantially the same as that by Mr. Flood above. Hot melt, solvent cast, emulsion and extrusion coatings were all considered without much discussions of advantages of each. PVDC in particular was mentioned as barrier coating; shortcoming is that it does not seal rapidly. Nylon has been extrusion coated on polyethylene as well as the reverse.

Mr. Donald Buc[illegible] of Chase Bag Co. reviewed progress of the all plastic shipping bag to contain 25 lbs. or more. This development had a bad start because of high cost, poor seals and generally poor durability. It is now doing much better due to (1) good 5 mil film, (2) the development of a good valve for plastic bags and (3) the development of several refinements such as back seam bags, slip coatings, antistatics and finally good filling machinery for the 50 lb. bag. Market in terms of plastic consumed was estimated at 15×10^6 lbs. in 1965, 22×10^6 lbs. for 1[illegible] and a predicted 100×10^6 lbs. for 1970.

Mr. R. M. Carver of B. F. Goodrich described a thermoplastic urethane film with very interesting properties claimed for it. Among these are low temperature flexibility, toughness, oil resistance, impact resistance, good adhesion to other materials, flexural resistance, tear resistance and resistance to radioactivity. Cost was estimated at $0.083/1000 in^2 presumably for 1 mil thickness. Contemplated uses include storage of potable water, boil in pouch foods, meat packaging, etc. As far as could be determined FDA acceptance of these uses has not been obtained. The properties of this material [illegible] completely described in the Jan. 1966 issue of Modern Packaging, pg. 130 et seq.

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June 1[illegible], 1966

Mr. Charles Conklin of Lily-Tulip Cup discussed outlook for thermoformed containers: he believes a high untapped market exists where the package brings something new to market. One of the newest successes is the polyethylene thermoformed dish containing 1/2 lb. of soft cheese. Polystyrene failed in this application due to brittleness when polyethylene is used.

Beginning the second session on Plastics in Packaging, Mr. John F. Bloom, Jr. of Mobil Chemical discussed potentialities of structured films. By "structured films" he means those containing more than one strata of dissimilar materials designed to do a specific job, i.e. coated films, laminates, etc., where each element of the structure has a specific function. He mentioned many combinations including all of the low cost basic polymers and many emulsion coatings; he rejected questions on adhesives which he appeared to regard as the secret of structured films. Individual components of the structured film may impart gas impermeability, stiffness, abrasion resistance, slip, etc.; films may be oriented in one or both direction for "shrink" applications.

Discussing trends in "shrink" films, Mr. W. J. Vogel of Reynolds Metals indicated unparalleled growth with PVC showing the biggest gain. Shrink films were defined as those of (1) less than 3 mil thickness, (2) with "shrink" of at least 20%, and (3) producing tension of greater than 100 lbs. per inch. Mr. Vogel expects present market of 45,000,000 lbs. to increase to 400,000,000 lbs. in 10 years. The big new market for shrink films is the [illegible] case, i.e. shrink film replacing the corrugated paperboard box as outer shipping container. Hearings are presently being held by truck transportation and rail transportation committees which it is expected will lead to approval of this package by governmental agencies. At present Reynolds has shrink films available in widths up to 50-52 inches and will shortly produce 80 inch width films. They are recognized leaders in the shrink film field.