PLASTICIZERS FOR ENVELOPE ADHESIVES

INTRODUCTION

Envelope adhesives (frequently referred to as envelope “gums”) are a specialized subcategory of the larger adhesive grouping known as “packaging” adhesives. Although the performance requirements for envelope adhesives are not particularly severe and the paper substrates being adhered are not difficult bonding surfaces, the adhesives used in envelope construction are unique among packaging adhesives because of the “matching” requirements imposed on the adhesives by the very high (fast) speed of the assembly machinery used in the envelope manufacturing process. Further, the high speed machinery that is used to handle, stuff, seal, sort and process envelopes also imposes specific requirements on the envelopes. The selection of the plasticizers used in envelope adhesives is often critical to the performance of the adhesives, and thus the envelope, in both the manufacturing process and during the service life of the envelope.

TYPES OF ENVELOPE ADHESIVES

In the U.S., general purpose, commercial envelopes use two different types of adhesives. Envelopes which contain a “window” utilize the same two types of adhesives and also employ a third type of adhesive to hold the window in place.

The most recognizable adhesive on every envelope is the “front gum” or “seal gum” on the envelope’s closing flap. This adhesive is based on a polyvinyl acetate (PVA) homopolymer emulsion and is specifically formulated to be “remoistenable” (i.e.”lickable”). The remoistenable adhesive when applied to the envelope during manufacture, must dry quickly yet reactivate its stickness with the application of “human” or machine moisture. The adhesive’s “moisture response” is an important consideration where the envelopes are “machine licked” at high speed and with a minimum of water mist. This seal gum must also provide a degree of humectancy (the retention of a slight amount of moisture from the air – but not so much as to become tacky) so that the adhesive coating does not “dry out”, shrink and thus cause the envelope flap to curl excessively before use.

The second adhesive used in envelopes is the “back seal” or “back gum”. This adhesive holds the folded lap joints of the envelope together. Back gum adhesives are typically starch modified, polyvinyl acetate formulations. The principal requirement of a back gum is that it have enough humidity resistance to hold the adhesive bond over the storage and use life of the envelope. These adhesives generally are not plasticized.

Envelopes which contain an address window in the front utilize a third type of adhesive. This adhesive us referred to as a “patch gum”. The proper industry term “window”, applies to the hole cut out in the envelope itself. The “patch” is the coated paper or plastic film, which covers the “window” and is held in place by the

adhesive or gum. Typically this adhesive is an ethylene vinyl acetate (EVA) copolymer emulsion containing plasticizer and is formulated to bond the treated/coated paper or plastic film to the paper envelope stock. Humectancy is also needed in a patch gum so that the envelope's front surface remains flat over time.

CHARACTERISTICS OF PLASTICIZERS FOR ENVELOPE ADHESIVES

The high speed, high shear conditions encountered in the manufacture of envelopes require that the plasticizers used in envelope adhesives be slightly "inefficient". Being inefficient, a plasticizer suitable for envelope adhesives will not be completely absorbed by the emulsified adhesive polymer. Thus, some of the plasticizer remains "free" within the adhesive emulsion to contribute to viscosity control and viscosity stability of the adhesive and to act as a lubricating agent during the high speed application of the adhesive to the paper envelope stock.

Further, the plasticizers used in both seal gums and patch gums should contribute significantly to the required humectancy of these adhesives. A plasticizer with the proper degree of hydrophilicity (moisture affinity) will retain sufficient moisture so that the adhesive does not warp, pucker or curl the paper surfaces to which it is applied. At the same time the plasticizer cannot be so hydrophilic that ambient moisture creates unwanted tackiness or destroys the adhesive bond between the surfaces. Plasticizers with a high Acid Value (AV) can provide the necessary moisture affinity so that the adhesive bonds retain their "flat" condition both before and during use. In addition, the combination of high hydroxyl value and high AV enables these plasticizers to emulsify quickly in the adhesive production process ad allow the application machinery to be quickly and easily cleaned and flushed with water.

In addition to the inefficiency, hydrophilic and emulsification characteristics required of plastcizers for envelope adhesives, plasticizers for patch gum formulations must also be non-migrating. Plasticizer migration from the adhesive to the surface of the coated/treated paper or plastic film patch covering the window can cause distortion of the patch, puckering of the edge of the window or failure of the adhesive bond altogether.

HALLSTAR PLASTICIZERS FOR ENVELOPE ADHESIVES

The special matching and performance requirements for envelope adhesives generally preclude the use of the normal, general purpose, emulsion adhesive plasticizers that are used in most packaging adhesives. The monomeric benzoate and benzyl phthalate esters are too efficient as plasticizers and lack sufficient hydrophilic characteristics to provide the properties needed in good envelope adhesives. And, if for no other reason, these plasticizers find little or no use in envelope gums because it is reported that they "taste bad" in remoistenable seal gums.

The HallStar Company offers two PLASTHALL® polymeric plasticizers specifically designed to meet the requirements of envelope adhesive formulations. Both materials, PlastHall P-622 and PlastHall P-900, are polymeric polyesters with medium molecular weights and high acid values (~25-30). Furthermore, the chemistry of both plasticizers is regulated for use in adhesives by the F.D.A. under 21 CFR, Section 175.105-ADHESIVES.

PLASTHALL P-622 FOR REMOISTENABLE SEAL GUM ADHESIVES

PLASTHALL P-622 has been specifically designed as a plasticizer for remoistenable seal gum adhesives. It possesses a combination of properties that make it the ideal plasticizer in this application. Its molecular weight, viscosity, ether linkages and low color (100 APHA, typical) give it all of the functional and aesthetic properties required for a seal gum. In addition, as an unterminated polyester with a high hydroxyl value and an AV range of 25-30, PLASTHALL P-622 provides both excellent humectant and moisture response properties in the adhesive film as well as rapid emulsification in the adhesive formulation. These same properties also enable an adhesive containing PLASTHALL P-622 to be easily solubilized in water for fast, easy cleaning of production equipment. PLASTHALL P-622 is accepted for use in adhesives by the F.D.A. That usage is regulated under Section 175.105-Adhesives, in the F.D.A. code, 21 CFR.

PLASTHALL P-900 FOR PATCH SEAL GUM ADHESIVES

PLASTHALL P-900 is a unique polyester plasticizer specifically created to meet the exacting requirements of patch gum formulations. PLASTHALL P-900 effectively plasticizes the copolymer emulsion to give excellent viscosity response and controlled viscosity stability, and at the same time provides the formulated adhesive the needed matching characteristics for sustained, high speed production runs. The molecular weight and aromatic, polymeric structure of PLASTHALL P-900 provide an excellent balance of adhesion to all types of patch material (coated and treated paper and various plastic films) and simultaneously ensures against plasticizer migration into the patch material. Also, the high hydroxyl value and AV of the plasticizer provide the needed benefits of rapid emulsification and incorporation into the adhesive formulation as well as easy clean up and flushing of the application equipment. The chemistry of PLASTHALL

P-900 is accepted for use in adhesives by the F.D.A. That usage is regulated under Section 175.105-Adhesives, in the F.D.A. code, 21 CFR.

CONCLUSION

Although envelope adhesives are a specialized and relatively small segment of the packaging adhesives market, the unique performance needs of these adhesives require specialized plasticizers. PLASTHALL P-622 and PLASTHALL P-900 supplied by THE HALLSTAR COMPANY have been developed precisely to meet the plasticizer requirements of envelope adhesive formulators. The combination of polymeric structure, chemical and physical properties and F.D.A. coverage of P-622 and P-900 have enabled these plasticizers to gain wide acceptance in seal gum and patch gum adhesives.