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An introduction to

Glueboard science



VECTOTHOR™

FLYING INSECT CONTROL

A) INTRODUCTION TO ADHESIVES

The adhesives used are glues with very special characteristics designed to grab and then hold very light but often strong insects over an extended period of time under very demanding conditions. The insects need to stick to the surface after the application of a very light pressure to the surface of the glue.

The general scientific name for this kind of glue is “ Pressure sensitive adhesives” (PSA). There are a multitude of pressure sensitive adhesives used in the packaging and a wide range of other industries, but while they may share the same origins the glues, used for insect trapping have developed into entirely unique products because of the very specific demands placed on them.

1) How the Glue Works

The aim of the adhesive coated on the traps is to stop and then to hold the insects.

The adhesion phenomenon can be split up in two:

- creation of interfacial glue-substrate bonds
- bond strength

In those two stages, three mechanisms take place: wetting, setting-up of interfacial bonds, and cohesion.

Wetting is the formation of the interface glue-substrate. To be efficient the glue must be able to wet the insect's legs. The glue should be fluid enough to be able to wet out on the surface of the insects legs and form the largest interface.

Once intimate contact is made, the strength and nature of the bond depends upon the chemical constituents at the interface. The larger the interface is, the more numerous are the bonds. Experience has proved that good adhesion is not enough to provide a good adhesive. It only constitutes a part of the properties needed to form a quality glue.



The bond strength depends upon the chemical nature, but also upon the molecular cohesion inside the glue. Cohesion is a phenomenon in which the molecules in the bulk of the adhesive are held together by primary and secondary bonds, as well as entanglements.

Adhesion calls for viscosity that acts by diffusion as well as the elasticity of the material. To sum up, we can say that pressure sensitive adhesives show features characteristic of both liquid and solid behaviour. That's why they are usually made of polymers, which are viscoelastic.

2) Nature

VECTOTHOR insect glues are made of three main constituents:

- *an elastomer*
- *a tackifying resin*
- *a softener*

The elastomer

The elastomer or rubber provides cohesion to the mixture. It defines the strength of the glue-substrate bond. It prevents glue failure when stretched. It is also the elastomer that provides the solid-like characteristics to the adhesive. Examples are rubbers such as natural rubber, polyisobutylene and chloroprene rubber.

The tackifying resin

The tackifying resin imparts stickiness to the composition. It is used to create the interfacial bonds. Typical products usually used are hydrogenated rosin, rosin esters, aromatic or terpene resins, aliphatic hydrogenated resins such are polymers of olefins having 5 to 9 carbons.

The softener

The softener imparts semi fluidity to the glue to enable the glue to arrest the legs of very lightweight insects and to retain a "wet" surface over a long period of time. The most typical softeners are liquid polybutene, liquid polyacrylates, low molecular weight phenol-formaldehyde resins, and many oils.

Proportions

The specific formulation of the adhesive depends on what it is used for. The effectiveness of any glue depends not only on the choice of the starting materials but also in fine tuning the proportions to achieve the balance required for it to work effectively. The composition should have sufficient softness and fluidity to catch the smallest insects with the cohesion to prevent the most powerful insects from escaping.

3) Mechanical properties

In a qualitative way, glues are usually described with three parameters:

- *Tackiness*
- *Peel*
- *Shear resistance*

Of these parameters, only shear resistance has a simple correlation with a basic polymer property: viscosity. The two others are expressed as results of rather complex tests.

Glue studies are usually done by comparison. In order to compare different sets of data, the tests are carried out at the same conditions e.g. temperature, coat weight and backing material.

4) REACH Compliance

REACH is a regulation of the European Union, adopted to improve the protection of human health and the environment from the risks that can be posed by chemicals. It is administered by the European Chemicals Agency (ECHA) and is likely to have implications well beyond Europe.

1. This directive has been developed in the past 5 years and deals with the reduction and / or exclusion of those chemicals that have an impact on the environment and health. Glue - used for our glueboards - previously contained certain chemical components, which fall under this REACH directive.
2. A list has been compiled with 65 SHVC (*) chemical substances (up till 21 Dec 2017), which will be critically looked upon (* : SHVC = Substance of Very High Concern)
3. A more strict norm change is coming up in 2018, to make sure that chemicals meet the strict norm. The components on the SHVC list may no longer be used in the formula, or the volume used in the product should be below a pre-set weight level.

Note that outside Europe also countries like South Africa and the USA are likely to follow this new directive.

What does this mean for our glue boards?

To meet the new REACH directive we have changed the glue composition and removed / replaced some of the chemicals, which were mentioned on this SHVC list. And:

To make sure the market understands that we are dealing with a product that meets the REACH directive we have introduced a new logo: The REACH compliant logo.



Because the standard glues available in the market are not meeting this new REACH norm, we now work with our own exclusive glue formula.

In the coming period we expect that many small manufacturing companies, who use ready standard glue formulas, will no longer be able to meet the new REACH standard and will be forced to stop production – or supply boards that do not meet the REACH directive.

B) INTRODUCTION TO TEST PARAMETERS

In use glues need to perform optimally over very extended periods under harsh conditions. Before commercial launch any glues are subjected to a range of gruelling tests to verify their performance.

- *Light stability*

To compare the light resistance of the glues samples are exposed to UV light normally 1.5×10^3 Lux. This simulates field use conditions for the glue. Samples are exposed to the lights for extended periods and at regular intervals analysed to determine how degradation has affected the glue characteristics.

- *Coat weight optimisation*

Coat weight is critical to the performance of a glue and it is dependent upon the target insect groups.

- *Chemical stability*

To assess chemical degradation glues are exposed at elevated temperatures and analysed to determine how the glue is affected. This test not only tests the characteristics of the glue but also of any potential substrate. Glue penetration into the substrate can be a major factor in the deterioration of its performance.



1) Test equipment

The above adhesives properties involve some mechanisms that are not easy to study from a mechanical point of view. Specialised equipment is needed for rheological and mechanical studies on glues.

The Tack-Tester

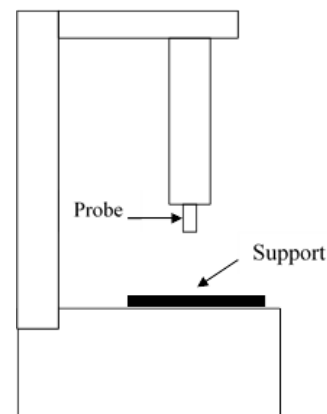
This appliance allows us to visualise the forces needed to withdraw an object coming in contact with the glue surface.

A probe with a given surface area, travelling at a given speed and applying a given force comes in contact with a glue sample on the support for a given time.

The probe is then withdrawn at a known constant speed while the appliance records the strain needed.

Data processing lets us plot the curve for force over time ($F = f(t)$).

As time and probe travel are proportional, it is also possible to plot force over distance ($F = f(d)$)



2) Field testing

Of the glues showing what appear to be desirable Traits. Only the most promising are selected for field testing on target insects. Glues of different coat weights and ages are tested in the light traps to determine their performance.

The tradition has been to use the current commercial glues as the standards. The object is to develop a glue which significantly improves on the performance of the current commercial options AND meets the environmental (REACH) standard.

Once these parameters have been optimised, commercial samples are produced which are provided to key customers for final approval.



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