Harry F. Bader

On aging test failure, making softer surgical gloves, siliconisation problems etc

We are manufacturers of latex dipped medical product. We have developed our own in-house compound with centrifuged latex (60% DRC). The compound formulation was standardized based on the product quality requirements. The latex film was casted and was sent to RRII - India, for testing the physical properties like tensile, modulus & elongation (before & after) aging. It is meeting all the physical properties before aging. But it has failed in the aging test (aged 100° C for 22 hrs.). Film got melting after aging.

We have used standard vulcanization system. The ingredients used for compounding are sulfur, zinc oxide, ZDBC & 0.4 phr of antioxidant, all FDA approved.

We tested the latex film of the final compound for presence of any manganese, copper, iron etc, by using Atomic absorption spectra photometry. The test results are:

Sl. No.	Description of the test	Cenex (60% DRC)	Compound
1.	Copper	0.26	0.63ppm
2.	Iron	BDL	10.24 ppm
3.	Manganese	4.36 ppm	Below detecting level

Can you please provide your technical guidelines regarding the reason for failures?

M. Mathiyazhagan
Telefax Medical Private
Limited, Pondicherry

I've never liked the 100°C aging temperature for natural latex films. This temperature is in the vulcanization range for many compounds, particularly those with ZDBC. The butyl dithiocarbamate is an aggressive accelerator which unless the PDHR is quite low will continue to cure at 100°C. I know that 22 hrs. @ 100°C is roughly equivalent to 168 hrs. @ 70°C (21 hrs. would be exactly equivalent). However, at elevated temperatures, the reaction is different than at the lower temperatures.

Before you take action, I suggest you determine what your product is like after 168 hours @ 70°C.

The metal content of your latex seems alright. However, the increase in both Copper and Iron after compounding, indicates either your added ingredients or your compounding equipment are increasing the metal contamination. That's not good and if not corrected it is likely to become worse.

•••

I am a chemist in one of the glove manufacturing companies in Malaysia. I have a few questions to ask for your advice:

1. How to make a softer surgical glove?

2. Can plastisicer make the glove softer?

3. What type of plasticiser is suitable to be used for NR rubber glove and for synthetic glove and what is the concentration to be used?

4. How to achieve a good quality of chlorinated glove? Currently we chlorinate the glove using gas chlorination. The problem we face is the gloves has yellow-patche discoloration after chlorination. The patches appear on the glove surface after the gloves have been kept for 3 or 4 days at ambient temperature.

▶

Harry F. Bader, Vice-President, Latex Services, Akron Rubber Development Laboratory, Akron, USA, and a world authority on latex, answers questions and doubts of readers on latex and latex products.

Send your questions to:

'The Latex Doctor'
Rubber Asia,
Dhanam House,
Cochin - 682 020,
Kerala, India
Fax: 91-484-2317872

The yellow patches disappear upon additional chlorination of the gloves.

Kang Geok Shien

This question came to me many months ago. It apparently was temporarily lost in my files. My apology.

To make a softer surgical glove means to me that you want a lower 300-500% modulus along with a somewhat higher elongation. To achieve that, I suggest a reduction of both zinc oxide and sulfur. You also might want to change your accelerator.

This should be done with caution. Always try formulation changes in the laboratory before you change things on the production line.

I've not had success with the addition of plasticizers to a medical glove compound; so I've never done a production run. There are "plasticizers" available from chemical suppliers. Again, try new ingredients in the lab, not on the production line.

Chlorination can work well if it is well controlled. Some of the things which may be the source of your patchy discoloration are:

o Varying Cl2 concentration. I've used .06%.

o Overloading the chlorination reactor with too many gloves.

o Varying amount of Cl2 in the reactor.

o Varying time of chlorination.

o Poor or insufficient neutralization.

o Overloading the dryer with too many gloves.

o Poor dryer temperature control. Always control the incoming air temperature. If you control the outlet air you don't know what the temperature is on the product. Chlorinated latex film starts to discolor at 50°C. Your inlet air should not exceed 50°C.

o Too short drying time.

If you vary the conditions, your results will vary.

• • •

We do siliconisation of rubber product using silicone emulsion. After this the products are gloosy and transparent, but on storage-after 2 months-it became dull and not transparent-no more silicone on the surface!!! How to avoid this problem?

Anonymous

This is not surprising. The silicone oil or emulsion has been absorbed into the product. Sometimes this can be reversed by warming the product in a tumbler with some cotton rags to polish the surface. However, this is not possible when your product is packaged and on the store shelf.

There are several alternatives which could be investigated:

o Put a barrier dip on your product prior to the silicone emulsion. This would take some experimentation to find a suitable barrier material which would not affect the product properties.

o Change the polish dips to something which would not be absorbed into the product. Here again, this requires experimentation, as well as the selection of a non-toxic material.

o Add an ingredient to your compound which would increase the resistance to permeation by the silicone emulsion. This also requires experimentation.

I have no ready-made solutions. These are merely avenues for investigation of possible solutions.

• • •

I don't want to compete with your latex doctor, but his article on page 85 about measuring flow viscosity was less than complete.

The question was about flow characteristics and he answered it by referring to a shear viscometer? Later he said latex compounds are thixotropic. Surely some are not.

I believe he would have been more correct had he referred to the use of a flow cup meter, albeit that some feel that this may give enormous data. However, given that test sample is subjected to a standard stir condition, and at temperature prior to the test, then the data is reliable.

▶

The shear viscometer provides information needed by an academic, but this is not necessarily what the shop floor technologists are concerned with. Where a more discerning case exists, it is practical to use even a tube viscometer, or a burette!

Richard Scott
U.K. subscriber

It's flattering to know that Richard Scott is a reader of my regular articles in *Rubber Asia*. We've never met, but I am aware of his valuable contribution to the advance of latex technology.

Mr. Scott is right. Not all latex compounds are thixotropic. However, if you are dipping it is likely your compound is thixotropic. It is often the case that the compound recipe includes additives to increase that property.

Mr. Scott is also right that there are many alternatives to a proper shear viscometer flow characteristics study. However, although the collected data may be, as he states, "enormous" it is also likely to "erroneous". I've encountered all types of testing methods in Canada, U.K., Australia, Thailand, Malaysia, Mexico, Puerto Rico, Bolivia and the U.S. The problem is when you have your own unique method which is likely to produce a subjective result, it is also likely to be meaningless to the technologist in another country.

If we want to be on the same level of data, we should be using the same test. A "Brookfield" Model LVT or its equivalent will produce the same data for-when operating conditions are the same.

• • •

Just wondering if you could answer a couple of questions for me; I was referred to you by Monica Oberst at Mayer Labs.

I am doing a research project for an organic chemistry class on the effects of oil-based lubricants on latex condoms and was interested in the exact chemical process that causes the latex to disintegrate. I'd like to know if it's a simple 'like-dissolves-like' reaction between the two non-polar substances [cis 1-4 polyisoprene and mineral oil or petrolatum (C16 to C20 hydrocarbon chains)] and/or if there's a more complex reaction that occurs between the oil and the stabilizers.

Laura Jenson

The degradation we see when a condom is coated with a lubricant is easily detected and quantified by the three tests we perform for US FDA approval of new latex.

o Physical testing before and after 30 minutes exposure to the lubricant @ 37°C and 95% RH. This shows a drop in tensile strength; and increase in modulus and an increase in elongation if the lubricant "attacks" the latex film.

o Water leakage before and after, as above, will show more leaks. This is usually due to the thin film over a bubble breaking when the water fills the condom (really a tensile break).

o Air Burst Testing before and after as above. The pressure and volume at break, decreases.

Mineral oil and petroleum jelly are very aggressive as compared to normal condom lubricants which must be tested before they are approved by USFDA/

We've thought of these as physical changes with the lubricant penetrating the latex film and causing swelling. The greater the crosslinking during vulcanization, the less the swelling.

It is possible after the latex film has been swollen by the lubricant, to remove the lubricant by carefully washing the film in warm soap and water. Physical properties will come back to, or very near their original levels.

This ability to "launder' the film to remove the lubricant is evidence that its changes in the film property are "physical" rather than "chemical". ■

Correction

Some errors have crept in the column in March-April '04 issue. The term "chloroform pressure" in Para II of question 3 should be "chloroform precure" and "latex dip tank and agitator speed" should be "latex dip tank agitator speed."