The Ohio State University / Food, Agricultural and Biological Sciences

Practical Applications for Guayule Latex Films

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INTRODUCTION

Parthenium argentatum, or guayule, is a shrub that can be harvested and used to create latex. Unlike the commercially available Hevea latex, guayule latex is hypoallergenic, which is beneficial for individuals with latex allergies. guayule latex products have properties that are similar to Hevea latex..

The purpose of this project was to create practical products using the alternative rubber source guayule. The first product would be a thin film that is applied to wall surfaces to capture particulates in the air. This would be used in a hospital setting to clean a room after a patient has left, by stripping the coating from the walls, floors and furnishings, and destroying the films with any pathogens in an incinerator. The next use would be a pre-paint strippable primer that would go on the wall before the paint is applied. This would be used as a testing strip to determine how a paint color would look without getting any paint on the wall. Both products would be strong and easy to peel.

METHODS

1) Formula

A total of six formulae were created. Half of them were created using the traditional accelerators, ZPEC and DPG, while the other half were created using the alternative hypoallergenic accelerators, ZDNC and DIXP. The amount of accelerators present increased with each batch.

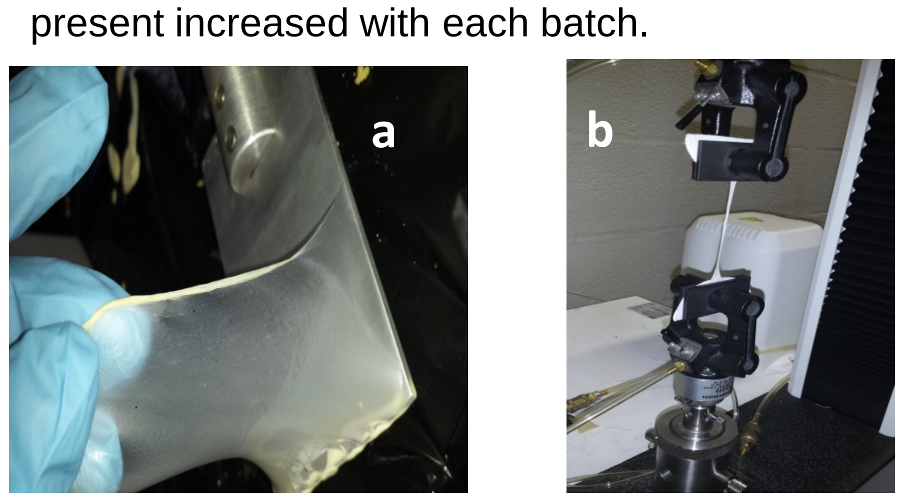

Figure 1(a) shows the creation of films for testing. Two coats of the compounded latex were applied to the former using a sponge brush . Once the latex dried it was peeled off. Figure 1(b) shows a dumbbell being tested by a tensiometer. The machine stretches the strip and records tensile strength, breaking point and additional properties.

2) Film Testing

Films were created by allowing the latex to solidify on a metal former. For each batch, 2 films were produced with heat and two films were produced without heat. From these films, dumbbells were cut out according to the ASTM D412 standard. These dumbbells were taken to the tensiometer to measure the strength and elasticity of the films. The strongest films were used for the paint and particulate testing.

3) Paint Testing

A solid surface was coated with the latex. After the latex dried, a single coat of paint was sprayed on the coated wall. Once the paint was dry the film was peeled off. The uniformity of the peel and the amount of paint leftover was recorded.

4) Particulate Testing

A petri dish was tared on a scale. A latex film was created on the surface of the petri dish and that weight was taken. Then 1.0 g of talcum powder was evenly spread on the surface of the petri dish. All lose powder was knocked off and the weight of the remaining powder was recorded.

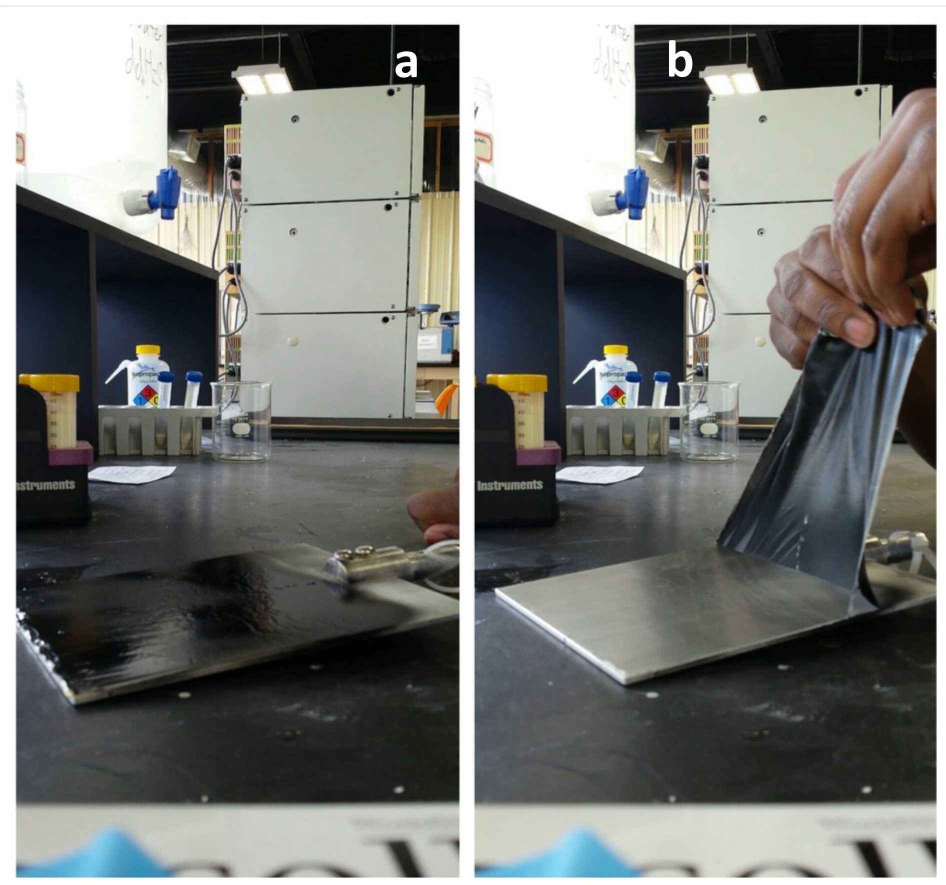

Figure 2(a) shows a metal former coated in a double layer of latex film and a single layer of black paint. Figure 2(b) shows the latex film being peeled of in one piece, leaving no paint on the metal former.

Particulate Test Results

	Test #1	Test #2	Test #3
Weight of dry latex (g)	1.189	0.945	1.068
Particulate added (g)	0.961	1.000	1.000
Particulate retained (g)	0.198	0.107	0.123
Percent Retained	20.60%	10.70%	12.30%

RESULTS

Film Testing

- The compounds with the DIXP and ZDNC accelerators outperformed the compounds with the traditional accelerators.
- The addition of a heat source created stronger films than those without a heat source.
- An increase in accelerators is not positively correlated to a stronger film. An excess of accelerators may cause the film to become weaker.
- The circumallergenic compound with heat (New Recipe 1) was selected for testing because of its highest average tensile properties.

Paint Testing

- The film was able to hold the single layer of paint without sacrificing the structure of the film. The peel was uniform and left no paint residue under the film.

Particulate Testing

- On a petri dish with an area of 6.36 m^2, the film was able to capture about 0.142 g of talcum powder on average.
- The film was still able to be peeled uniformly. After the peel a small amount of particulate fell off.

BIBLIOGRAPHY

1. Slutzky J.L., Soboyejo A., & Cornish K. (2013). Type IV Hypoallergenic Natural Rubber Thin Films: Multivariate Comparative Analysis of Ultra-low Protein Hevea Latex vs. Circumallergenic Guayule Latex, The Ohio State University, Wooster, OH.
2. Slutzky J.L., Soboyejo A., & Cornish K. (2013). Multivariate Analysis of Type I and Type IV Circumallergenic Natural Rubber Latex Films, The Ohio State University, Wooster, OH.

Tensiometer Results

Specimen name	Load at Absolute Peak	Load at Break	Tensile strain at Break	Tensile strain at Absolute Peak
New Recipe w / Heat 1-1	3.304	0.409	596.858	590.13
New Recipe w / Heat 1-2	2.806	0.412	534.148	506.33
New Recipe w / Heat 1-3	5.333	3.999	876.936	867.55
New Recipe w / Heat 1-4	2.462	0.146	321.427	311.7
Traditional Recipe-1	1.17	0.151	204.831	197.83
Traditional Recipe-2	3.714	1.31	238.159	228.62
Traditional Recipe-3	0.67	0.014	337.812	328.21
Traditional Recipe-4	0.938	0.027	319.09	306.53
New Recipe w / Heat 3-1	1.431	-0.03	392.729	382.22
New Recipe w / Heat 3-2	2.982	0.062	581.925	573.97
New Recipe w / Heat 3-3	3.223	0.188	676.692	654.98
New Recipe w / Heat 3-4	1.37739	0.88864	283.76294	228.78822

CONCLUSIONS

The latex films have the capability to act as a pre-paint primers and a s a strippable wall coating. A recipe using the DIXP and ZDNC accelerators as well as a heat source provides the strongest formula.

An increase in these applications not only create innovative solutions to everyday problems, but also promote the production of guayule latex. An increase in guayule use could prompt an economic boost in areas where the shrub can be grown like South Africa.

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