



## Wild Versus Cultivated Rubber Latex Characterization for Condoms Application

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**Abstract:** The objective of this work was to evaluate the quality and processability of different grades of wild rubber latex by using the rubber process analyzer (RPA), and analytical methods. This work was developed within the frame of a collaboration among the Brazilian Health Ministry, the Macromolecular Institute (IMA/UFRJ) and the National Institute of Technology (INT), intended to characterize the wild latex to be used as condoms. In Brazil the latex used to produce condoms comes from South East Asia, and thus the results obtained in this work were compared with those obtained with the latex from Malaysia. The results permit to conclude that it is possible to produce condoms from wild latex, which is not the usual raw material in Brazilian industries.

**Keywords:** Natural rubber, Latex, Condoms, RPA

### Introduction

Natural rubber latex (NR) is obtained directly from the *Hevea brasiliensis* rubber tree, of the Euphorbiaceae family, by tapping and collecting the fluid, which flows, from the spiral cut made almost through the bark, but just short of the cambium or growing layer. *Hevea brasiliensis* is indigenous to the Amazon Basin where it grows wild. Natural latex is a colloidal dispersion of a polymer in water. The basic unit of the polymer is cis 1,4-polyisoprene (1).

Nowadays the production of natural rubber latex from Amazon does not have commercial importance and Bahia, São Paulo and Mato Grosso do Sul states became the principal producers, as a consequence of clonal development (2).

In 1999 the Brazilian production was 70,000 tonnes and the consumption was 170,000 tonnes (2). The worldwide consumption of natural rubber is over 7 million tonnes. Most of this is converted to solid rubber, with over 70% being used in tires. The amount used in latex form is less than 1 million tonnes (14%). The major natural latex markets, gloves and condoms, have benefited an increasing growth with the advent of pandemics such as HIV, stressing the necessity for protection against infective disease (3).

A collaboration project was then established among the Health Ministry in Brazil, the Macromolecular Institute (IMA/UFRJ) and the National Institute of Technology (INT) in order to characterize the wild latex to be used as condoms. Condoms are already produced in Brazil, but the latex used comes from South East Asia. The objective of this work was to evaluate the quality and processability of different grades of native natural rubber latex using the rubber process analyzer (RPA), and analytical methods. All results were compared with the latex from Malaysia, used in condom production.

### Experimental part

*The analytical characterizations were based on ASTM D 1076 (4).*

Processability was determined for all samples on the RPA 2000 (Rubber Process Analyzer). The measurements were taken according to ASTM D 6204 (5). This equipment is specially designed to test rubber materials such as raw polymers and fully compounded stocks. The RPA strains a sample in shear by oscillating the lower die sinusoidally. Oscillation frequency can be set from 0.1 to 2,000 cycles per minute (cpm) (6). The magnitude of the lower die movement can be set by angular oscillation of the lower die or by the required strain on a sample. The lower die can oscillate from 0.05 degree of arc to 90.00 degree of arc. Those angular oscillations correspond to a strain of 0.7% to 1,256%. The temperature can also vary.

*Test conditions: temperature 100°C at 6 cpm with strain variation*

Seven different samples (S1 to S7), from native region, and a mixture containing all these seven samples (M1) were analyzed. Three latex, from Malaysian cultivated trees (R1, R2, R3), used in condom fabrication, were taken as control references.

### Results and Discussion

Table 1 shows the analytical results, based on ASTM D 1076, for the mixture **M1**, and the three Malaysian latex used as control reference (**R1**, **R2**, **R3**).

All the results fit the range values accepted by ASTM procedure.

**Table 1 Analytical results of natural rubber samples**

Samples	M1	R1	R2	R3
Total Solid (ST) (%)	61.40	59.76	61.40	60.80
Dry Rubber Content (DRC) (%)	60.30	59.00	60.10	59.10
ST – DRC (%)	1.10	0.76	1.30	1.70
Total Alkalinity (%)	0.56	0.77	0.63	0.83
Brookfield Viscosity No.1 spindle, 30rpm (cp)	81.6 27°C	60.0 (24°C)	99.20 (24°C)	59.50 (24°C)
Brookfield Viscosity No.1 spindle, 12rpm (cp)	102.5 27°C	76.25 (24°C)	131.62 (24°C)	76.25 (24°C)
Volatile Fatty Acids	0.023	0.039	0.027	0.031
pH	10.90	10.80	10.57	10.89

The RPA results are shown in Figure 1 from which it is possible to make a comparative analysis between the latex mixture M1 and the references samples (R1, R2 and R3) for the study of the elastic torque versus strain sweep.

These latexes, although extracted at trees from different areas, gave similar rheological results. These results and the analytical one are strongly dependent on the treatment given to the material from the very beginning, in the other words, from cutting to the condom final production.

**Conclusion**

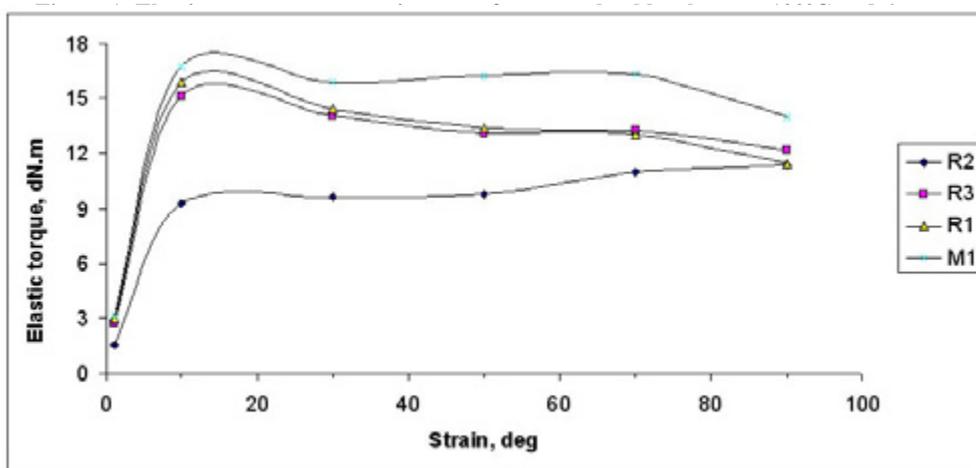
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