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PARTICLE SIZE INVESTIGATION ON NATURAL RUBBER FROM DIFFERENT CLONES OF BRAZILIAN IAC SERIES

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Hevea brasiliensis species are being investigated in order to increase the production of natural rubber and to develop new clones more appropriate to specific soil and climate. Particle size of natural rubber from *Hevea brasiliensis* (Willd. ex Adr. de Juss.) Muell. - Arg. coming from new clones from the IAC series (IAC 405, 406, 410, 413, 420, 300, 301, 302, 303, 56, and 40) and from RRIM 600 (used as a control) has been studied using laser light scattering and scanning electronic microscopy (SEM). The results have shown that the average size of rubber particles varies within and among clones. In average, the particle size of clones from Votuporanga city is larger than that of those from Mococa city. The rubber particles of IAC clones exhibited predominantly a spherical shape characteristic of *Hevea* and other rubber species.

Introduction

Natural rubber is a essential and strategic raw material used in the manufacturing of more than 40,000 consumer products. Currently, the largest commercial source of natural rubber is *Hevea brasiliensis* (Willd. ex Adr. de Juss.) Muell. - Arg. [1].

Hevea is traditionally cultivated in humid tropics within 10° north and south of equator, where the quantity and distribution of rainfall and the ambient temperature are suited for its growth. Attempts have been made to extend rubber cultivation to the non-traditional regions of Brazil, where similar tropical climatic conditions exist. It has been extremely important the efforts to establish new zones for rubber cropping in Brazil demonstrating the potential for rubber production in regions such as São Paulo, Mato Grosso and Bahia states. The main goal of the genetic improvement of the *Hevea brasiliensis* is to develop species which are resistant to diseases, more productive and which can produce high quality rubber. Currently, field tests of the new IAC series clones are being carried out in São Paulo state, southeastern region of Brazil [2, 3, 4].

The ability to process rubber into a high performance product with abrasion resistance and tensile strength is correlated to high molecular weight of the cis-polyisoprene chain [1]. The particle size of natural rubber is an important parameter related to the biosynthesis mechanism controlling molecular weight in rubber trees [5]. In this work, the particle size of the natural rubber from new clones of IAC from Mococa and Votuporanga cities was studied.

Experimental

Natural rubber latex from different IAC clones from Votuporanga city (IAC 40, 56, 300, 301, 302 and 303) and RRIM 600 clone (used as a control), and clones of IAC 400 series from Mococa city (IAC 405, 406, 410, 413, and 420) and RRIM 600 clone (used as a control), in both cases, were collected from IAC experimental plantations. The stabilization of the latex samples was made using a (1:1 v/v) solution of Tris (Tris(hydroxymethyl) aminomethane) - 15.76 g/L, with 20% of glycerol.

The clones were grown for ten years in the plateau region of São Paulo state; the ecological conditions of which are summarized below [2]:

- Mococa city: 21°18'S, 47°01'W; altitude 665 m; mean annual temperature 24 °C; mean annual rainfall 1,500 mm; Eutrustok soil, with good nutrient status and physical structure.

- Votuporanga city: 20°25'S, 49°50'W, altitude 450 m; mean temperature during growing season 32 °C; mean annual rainfall 1,480 mm; Paleudalf soil, with average nutrient status and poor physical structure.

Particle size distributions were determined using a Horiba LA-900 Laser Light Scattering Particle Size Distribution Analyzer according to the manufacture's instructions. The particle size output was analyzed with LAM-900 and DISP200 software, using at least five different measurement of each sample.

Analysis morphology of the rubber particles was recorded in a Hitachi S 4700 SEM at 2.5 kV. The samples were prepared according to Wood *et al.*

methodology [6], glued in proper stubs and covered with gold in a Polaron E5100 sputter-coating unit.

Results and Discussion

The particle size distribution of rubber particles of IAC series clones from Mococa and from Votuporanga is shown in Figures 1 and 2, respectively. The distribution curves were normalized on the y-axis to facilitate comparison.

A wide unimodal particle size distribution ranging from 0.1 to 10 μm and presenting a similar shape was observed for rubber particles in latex for both, Mococa and Votuporanga samples.

Mococa clones presented, in general, a particle size average of 1.0 micron, including the control RRIM 660 with the exception of clone 410 which presented a higher average of about 1.7 μm, as shown in Table 1. The data indicated that the average size of the rubber particles varies within and among clones.

For Votuporanga, Table 2 shows the average of rubber particle size of IAC 300 series and the results for IAC 40 and IAC 56. It can be observed that IAC 40 and IAC 56 clones present larger average particle size than the average of IAC 300 series. The control, RRIM 600 clone, is the smallest of all clones, which can be an indication that a smaller particle size average may be a desirable feature, since the RRIM 600 is considered to be a high productivity clone which also presents a high performance on technological properties.

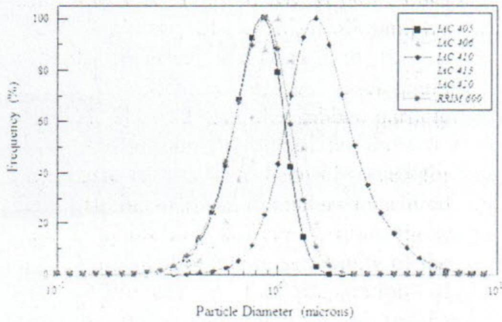

Figure 1 – Rubber particle size distribution of new *Hevea* clones of IAC 400 series from Mococa city.

Table 1 – Rubber particle size (with standard deviations) of new *Hevea* clones of IAC 400 series from Mococa city.

Samples	Particle size (μm)
IAC 405	0.8 ± 0.2
IAC 406	0.9 ± 0.3
IAC 410	1.7 ± 0.8
IAC 413	1.1 ± 0.3
IAC 420	0.8 ± 0.2
RRIM 600	0.8 ± 0.2

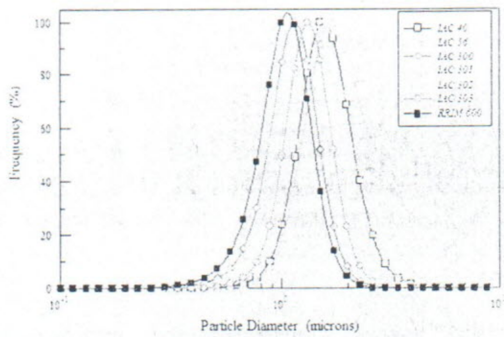

Figure 2 – Particle size distribution of rubber particles of new *Hevea* clones from Votuporanga city.

Table 2 – Rubber particle size (with standard deviations) of new *Hevea* clones from Votuporanga city.

Samples	Particle size (μm)
IAC 40	1.6 ± 0.5
IAC 56	1.8 ± 0.6
IAC 300	1.1 ± 0.3
IAC 301	1.3 ± 0.4
IAC 302	1.5 ± 0.5
IAC 303	1.3 ± 0.3
RRIM 600	1.1 ± 0.6

Figure 3 shows representative SEM micrographs of the rubber particles of IAC 420 and RRIM 600 clones from Mococa city. Rubber particles from all samples were predominantly spherical and varied in size as previously discussed. Both techniques laser light scattering and SEM, showed that the rubber particle size varies within and among the clones for the IAC series. The same basic results have been observed for all samples. Small rubber-particle diameters measured using laser light scattering differed from those observed using SEM, probably due to sensitivity of the instrument and differences in the preparation of samples required by these techniques. SEM results clearly show several small particles, which might have not been detected by the other technique, indicating the importance of the scanning electronic microscopy analysis.

Conclusions

A similar wide unimodal particle size distribution ranging from 0.1 to 10 μm was observed for rubber particles in latex for both, Mococa and Votuporanga samples. The average size of the rubber particles varies within and among clones. In general, the particle size average of clones from Votuporanga was bigger than those from Mococa. Rubber particles of IAC clones have the spherical form predominantly, consistent with other clones and rubber producing species.

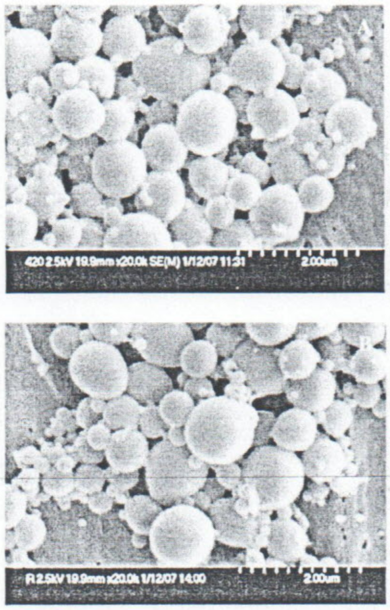

Figure 3 - SEM micrographs of IAC 420 (A), and RRIM 600 (B) rubber particles.

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