Analysis of Deformation of a Liquid Packaging Made with Board of the LPB Type

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Introduction: The liquid food products packaging are now predominantly made with LPB type board (Liquid Packaging Board).

In the process of storage, these packaging deform plastically and elastic. Consequently, it was evaluated the deformation profile.

Figure 1. Storage Packaging

Computational Methods: The deformations were evaluated considering a package made only board, homogenous, orthotropic and linear elastic. Typical elastic constants were varied according to Table 01, through the tool "parametric sweep".

Variable	Units	Minimum	Maximum
Liquid Density	kg/m^3	800	1200
Board Density	kg/m^3	600	1500
Young Modulus (MD)	MPa	5000	8000
Young Young Modulus (CD)	MPa	3000	4600
Poisson (MD)	-	0,2	0,45
Poisson (CD)	-	-2,5	0,4
Shear Modulus (MD)	MPa	1000	3500
Shear Modulus (CD)	MPa	8,8	15000

Table 1. Range of values used

After the initial analysis of the deformation profile, the internal volume was restricted with the use of the tool "Global Constraint" using equations 1 and 2:

$$\Delta V = \Delta V_{expansion} + \Delta V_{compression} = 0 \qquad eq(1)$$

$$\Delta V_{compression} = \Delta V_{expansion} \qquad eq(2)$$

Results: It was varied elastic constants and the density of the bottled liquid in the packaging. At the end, the deformation was compared with the real packaging (Figure 4):

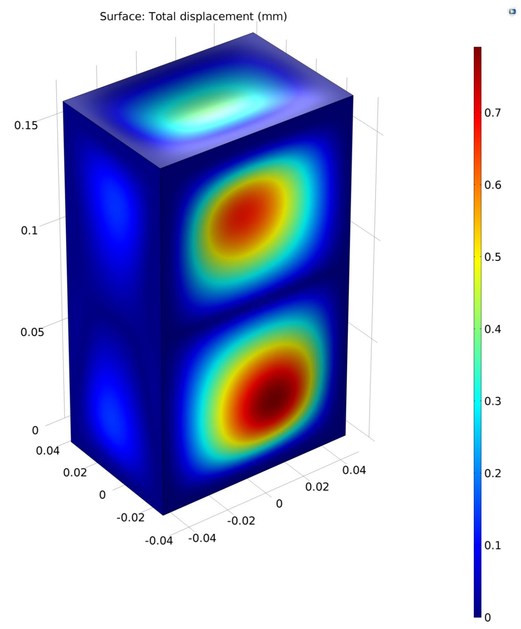

Figure 2. Profile Deformation

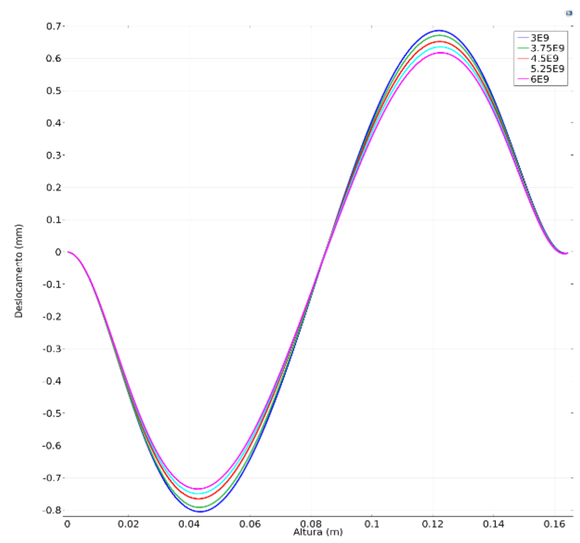

Figure 3. Young Modulus CD

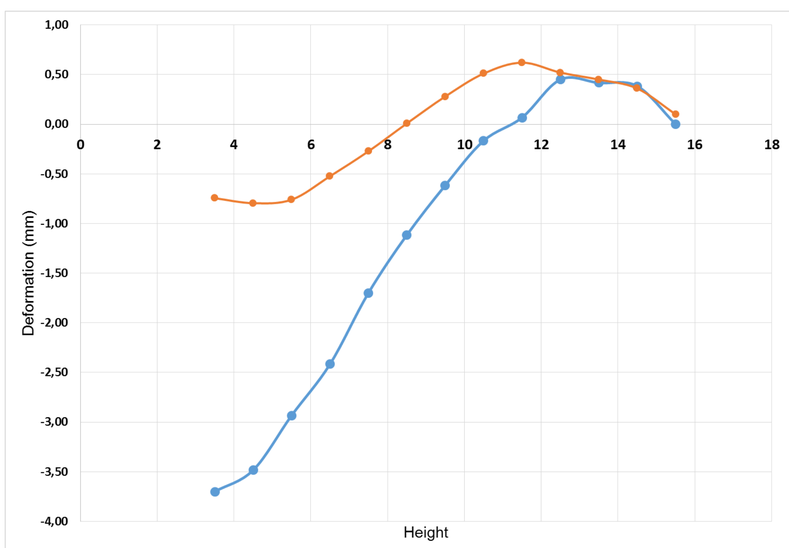

Figure 4. Comparison of the results obtained

Conclusions: The profile deformation is dependent on the Young Modulus CD, Poisson's ratio CD and of density of the liquid. The next step will be to study the board with polyethylene and aluminum.

References:

1. Levlin, J.E.; Söderhjelm, L.. Pulp and Paper Testing. Editora Finnish Paper Engineers' Association. Book 17, Ed.2ª,1999.
2. NISKANEN, Kaarlo. Mecânica de Produtos de Papel. Ed. Walter de Gruyter, 2012.