INFLUENCE OF REACTION CONDITIONS OF LIQUEFACTION IN THE VISCOSITY OF KRAFT LIGNIN-BASED POLYOLS

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INTRODUCTION

- Polyols are an important kind of compound due to the presence of hydroxyl groups which can react with other compounds to form a great variety of products.

- However, most of the commercial polyols are based in fossil source.

- In the other side, Kraft lignin has in its structure hydrosyl groups, it is renewable and is an abundant industrial waste.

- The Kraft lignin-based polyol is a potential candidate to replace those of petrochemical source in formulations such as phenolic resin and polyurethane.

- Properties → has a strong dependence of raw material source and of the reaction conditions.

- Viscosity → is one of the properties which is often used as a parameter for the use of a commercial polyol.

MATERIALS AND METHODS

Polyethylene glycol#400 (PEG)

Glycerol (G)

PEG: G
80:20

Catalyst:solvents ratio (0, 3, and 6% H_2SO_4)

Mass:solvents ratios (15, 20, and 25%)

Reaction time (60, 80, and 100 min)

Figure 1 – Reaction conditions of liquefaction under reflux

- The experiments followed an experimental design that totaled 27 runs

- Response Surface Methodology was used to show the influence of independent variables in the behavior of viscosity

Table 1: Experimenal design

Experiment	Time	Catalyst	Mass
01	80	3	25
02	60	0	20
03	60	6	25
04	60	3	20
05	80	0	20
06	80	0	25
07	60	6	15
08	60	0	15
09	80	0	15
10	100	0	15
11	100	6	20
12	60	3	25
13	100	0	20
14	80	6	20
15	100	3	25
16	100	3	15
17	80	6	15
18	80	3	15
19	100	6	15
20	60	0	25
21	80	3	20
22	100	0	25
23	60	3	15
24	60	6	20
25	100	6	25
26	80	6	25
27	100	3	20

Results

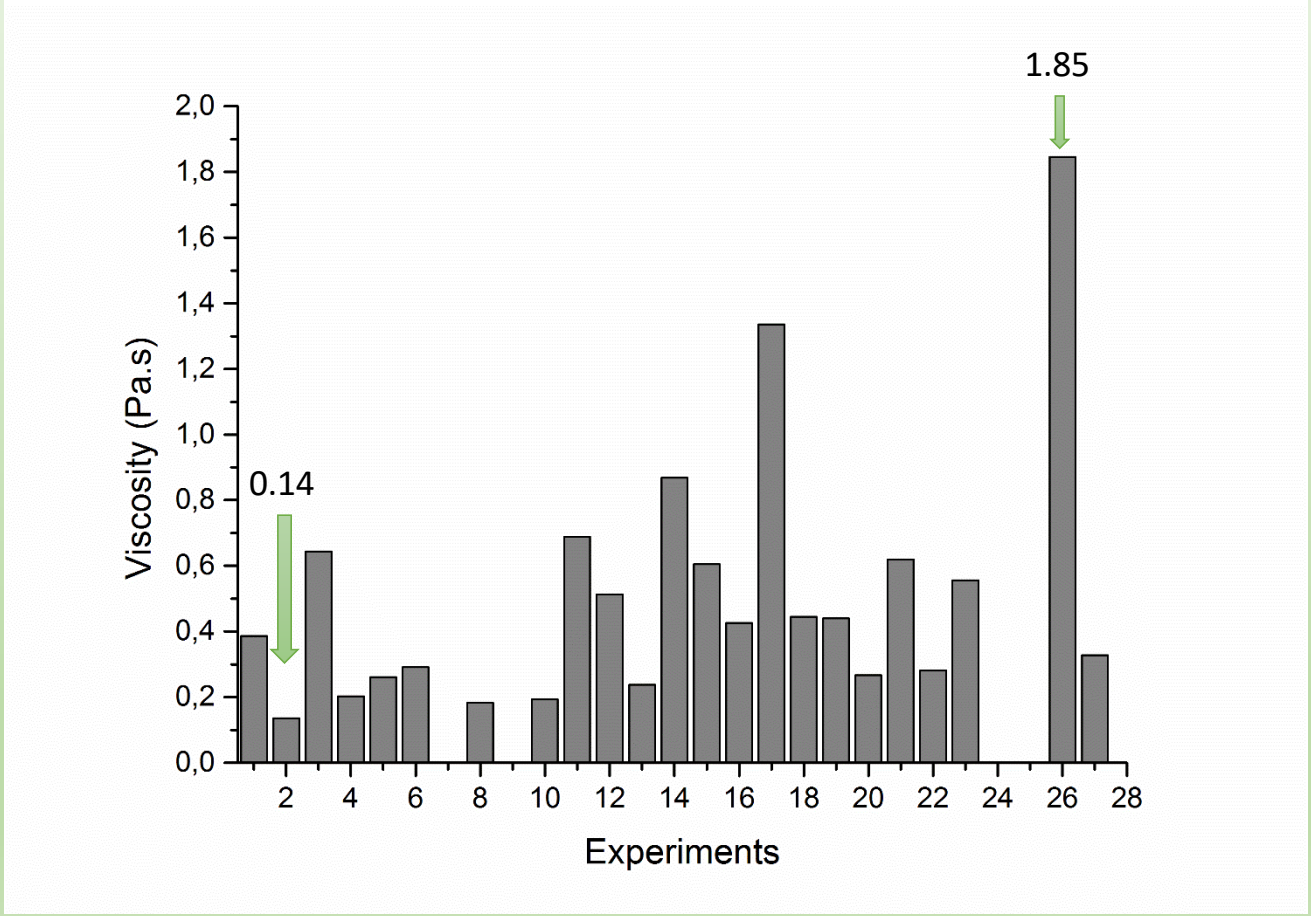


Figure 2 – Viscosity values of liquefied Kraft lignin-based polyol.

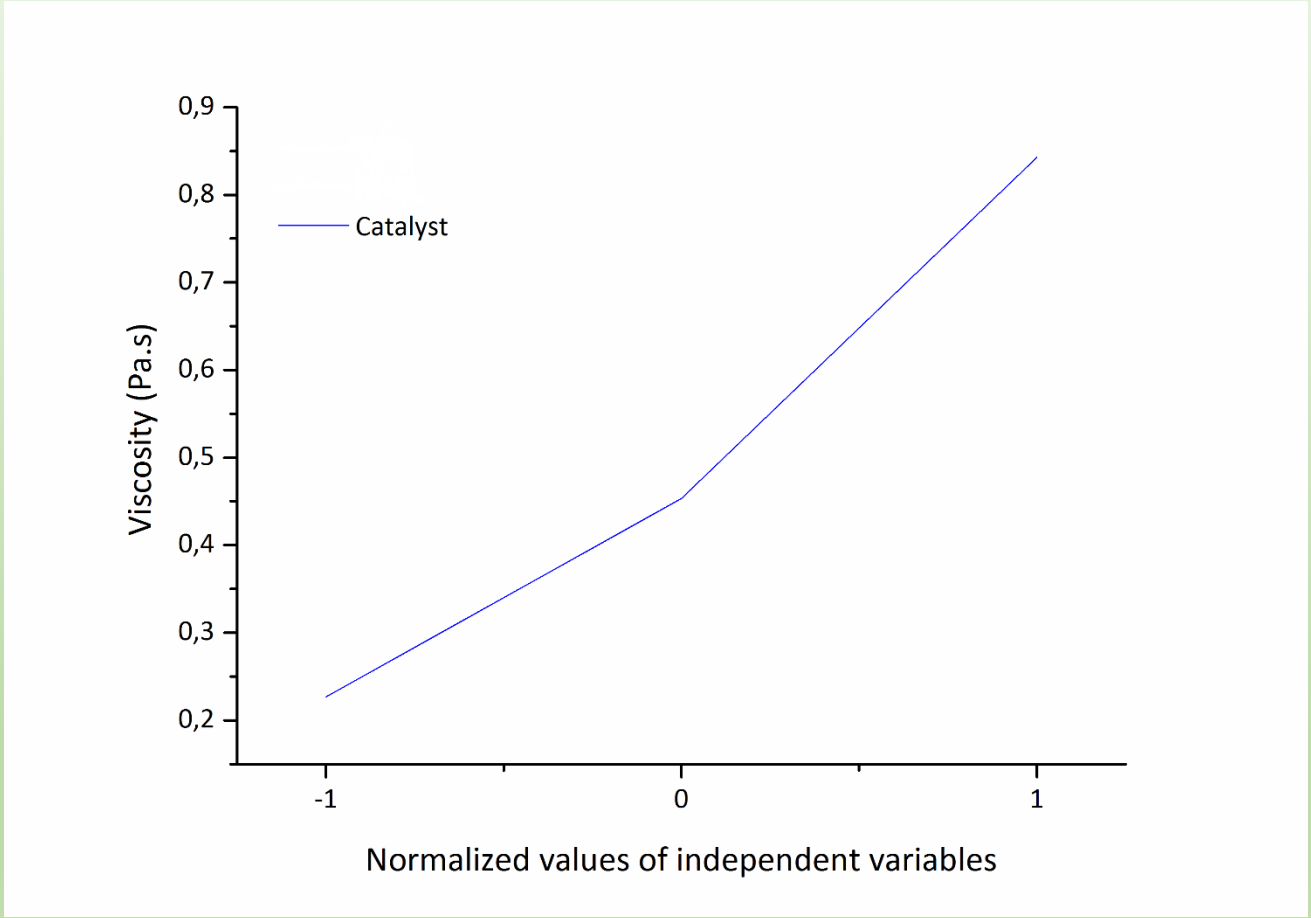
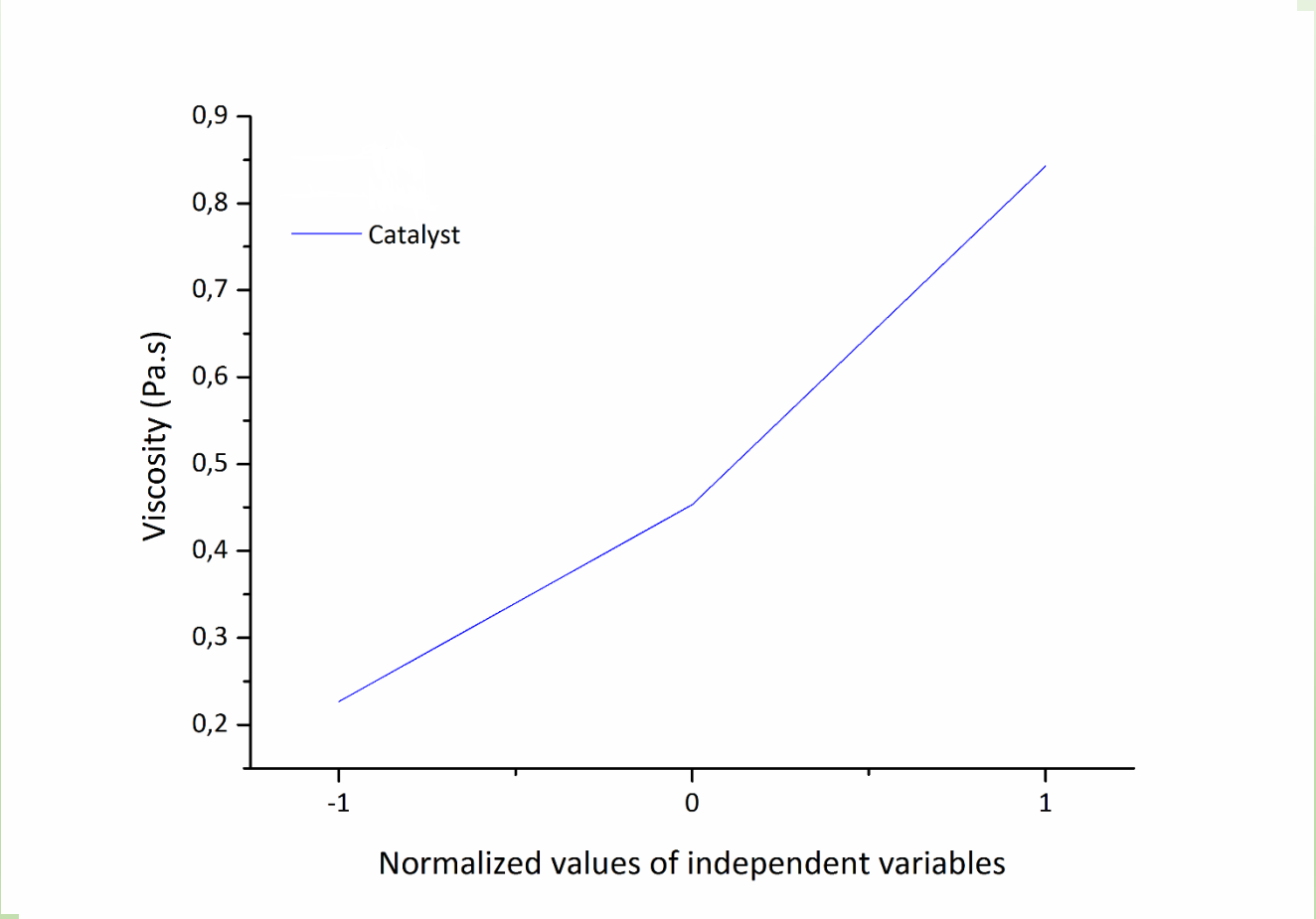


Figure 3 – Average values of viscosity as a function of independent variables



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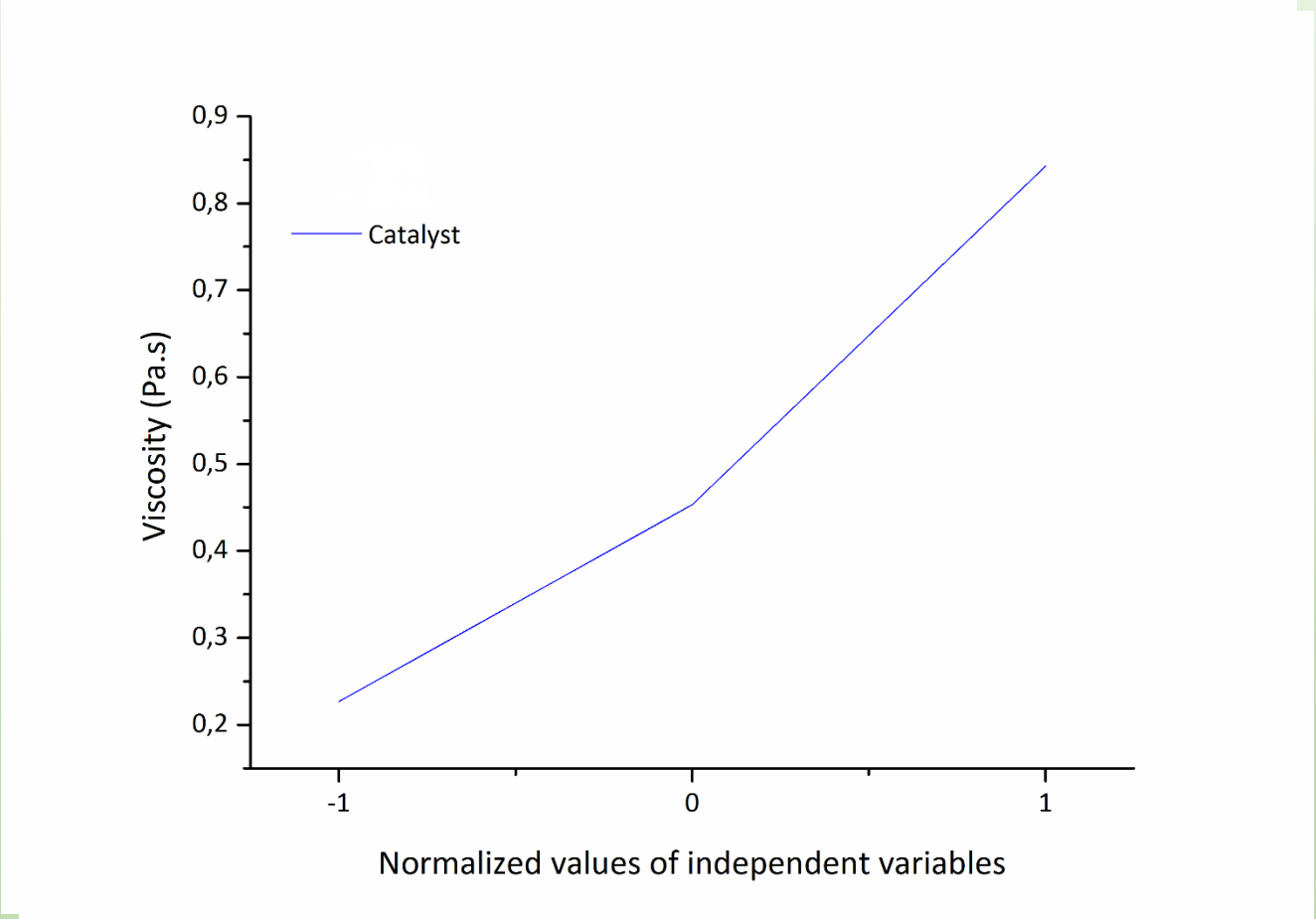

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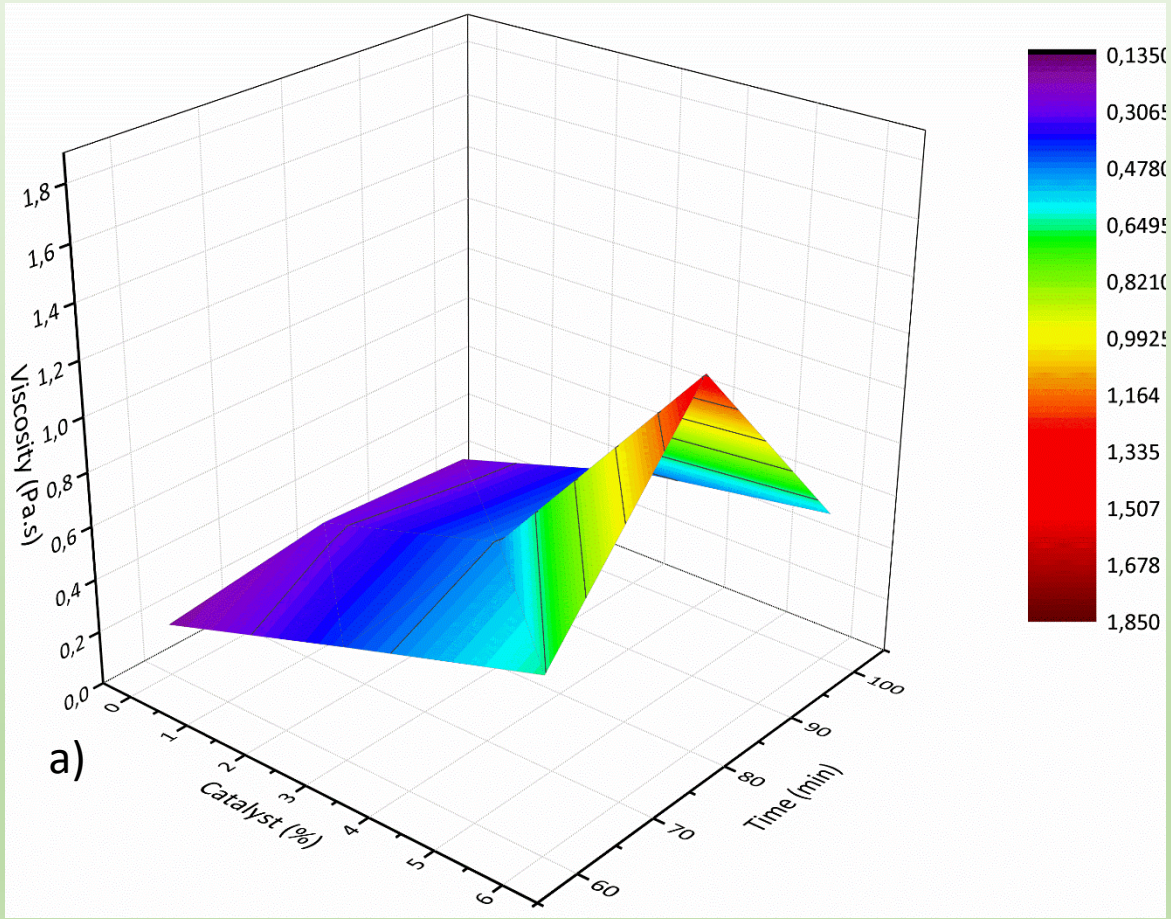
Table 2: Viscosity variance analysis (ANOVA) of liquefied Kraft lignins.

Source	Sum of squares	Df	Average square	F Rate[a]	P value
Main effect					
A: Catalyst	1.74765	2	0.873825	13.27	0.0029[b]
B: Mass	0.155493	2	0.0777467	1.18	0.3553
C: Time	0.473254	2	0.236627	3.59	0.0770
Interactions					
AB	0.114637	4	0.0286594	0.44	0.7801
AC	0.697839	4	0.17446	2.65	0.1122
BC	0.0280752	4	0.0070188	0.11	0.9769
Residue	0.526674	8	0.0658343		
Corrected total	3.74362	26			

[a] Are based on average square residual error, [b] Significant at 95% confidence level



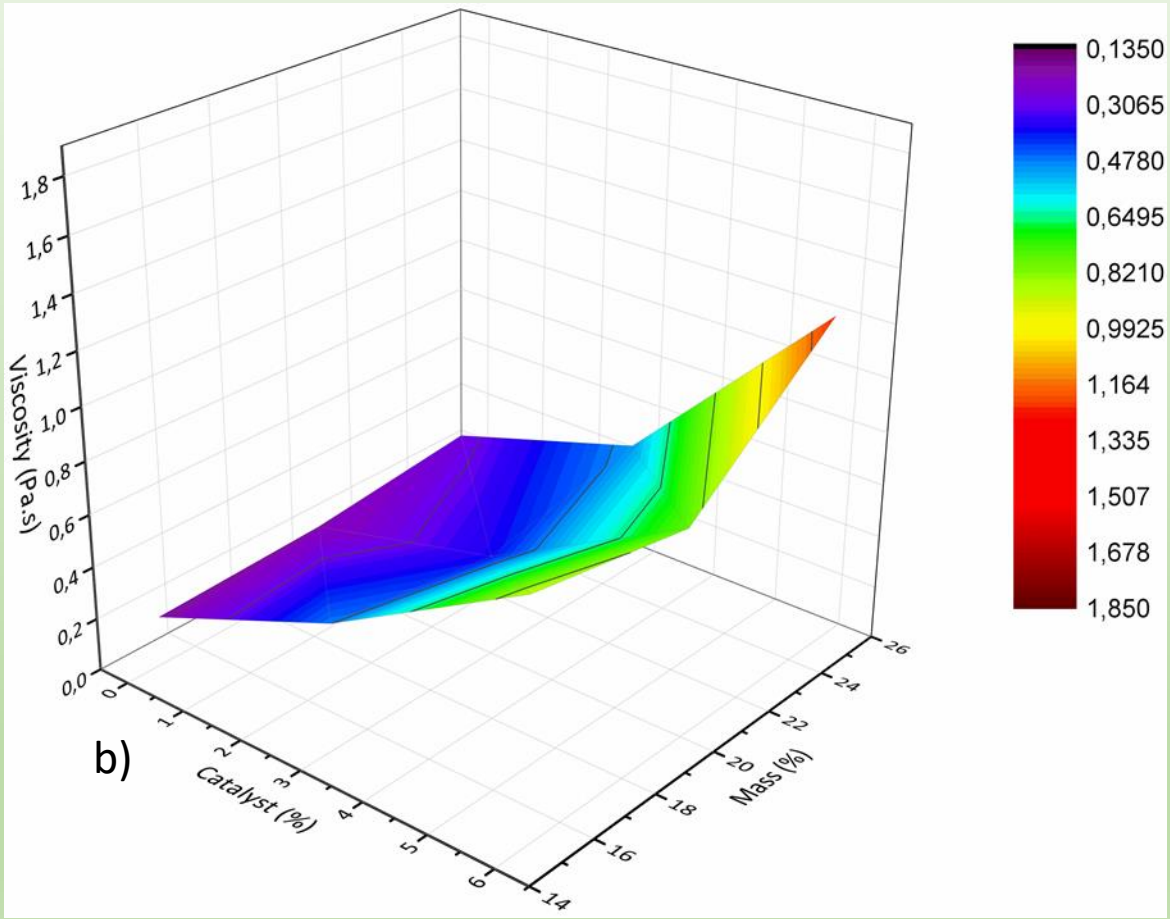


Figure 4: Interaction between variables a) catalyst/time and b) catalyst/mass

CONCLUSIONS

- All Kraft lignin-based polyols have suitable viscosity to replace fossil-based polyols in formulations such as rigid foams
- The lower viscosity values were observed in the absence of sulfuric acid
- The highest viscosities were verified with 6% of sulfuric acid

Thanks for your attention!