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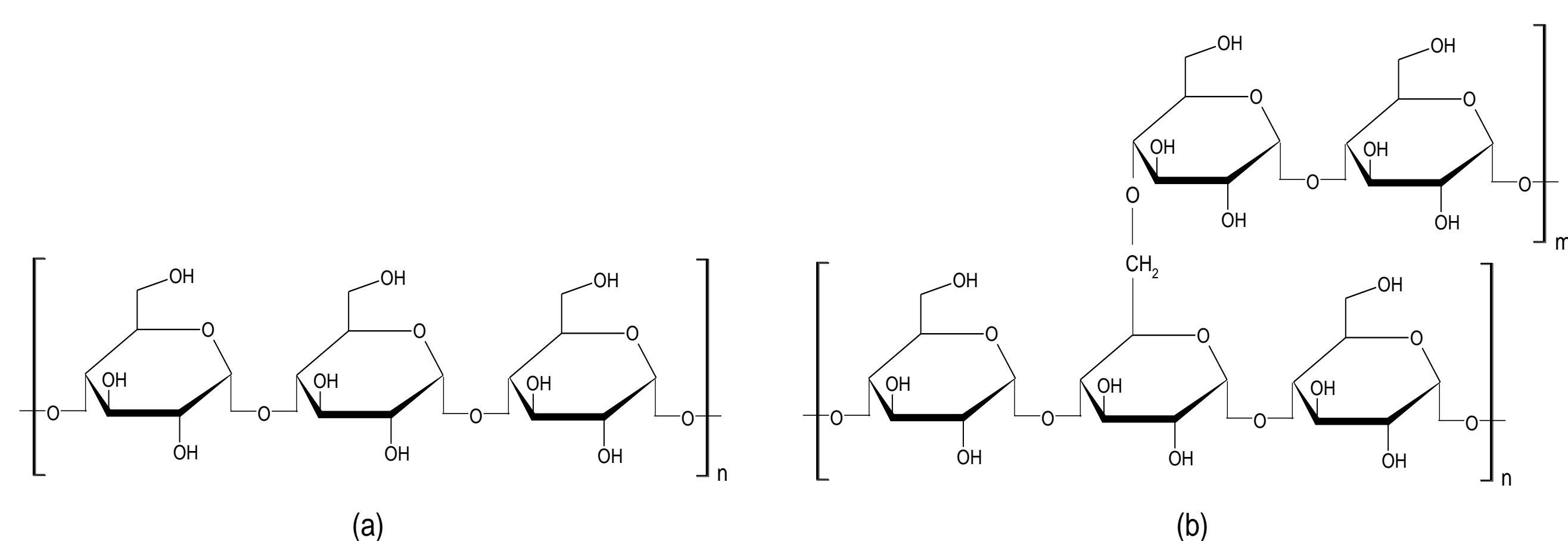
INTRODUCTION

Starch is a low cost and biodegradable material obtained from renewable sources. In its native form, starch is mainly composed by two kinds of polysaccharides, amylose and amylopectin (Figures 1a and 1b), whose proportion depends on the starch source. Cassava has a amylose/amylopectin ratio around 4.8, and corn, 2.7.

Cationic and/or anionic groups can be introduced in starch molecules, changing its original characteristics. The use of modified starch is common in papermaking for improvement of paper properties. In his study, Dang [1] observed an increase of 23.7% on tensile index of paper sheets formed with cationic starch.

The effect caused by cationic starch addition is particularly important in the manufacture of tissue papers, once cellulosic pulp refining, operation that also improves the strength properties of paper, is not an usual practice for this category of paper. On the other hand, both, the starch addition as well as the pulp refining, decrease the paper smoothness, which is an important parameter for tissue papers, and it is mainly related to structural properties of paper, such as specific volume [2, 3, 4].

This study presents the effect of 1% starch addition on tensile index and on specific volume, considering laboratory sheets formed with pulps of different refining degree, as well as the effect of starch dosage in these same parameters, considering laboratory sheets formed with a not refined pulp.



"n": 200 – 2000 anhydroglucose units
"m": 20 – 30 anhydroglucose units

Figure 1. Representation of amylose (a) and amylopectin (b) structures.

MATERIAL AND METHODS

For this study bleached pulp from eucalyptus and cationic starch, both commercial, were used. The pulp was refined to three different grades and laboratory sheets were formed with the refined and not refined pulps, following the ISO 5269-1:2005 standard method. In each situation was added 1% starch on dry basis. The specific volume (ISO 534:2005) and the tensile index (ISO 1924-2:1994) were determined in the sheets formed. These same parameters were also the ones determined in the study of the effect of starch dosage, where laboratory sheets were formed with the no refined pulp using the following starch concentrations on dry basis: 0%, 1%, 3%, 6% and 9%.

RESULTS

Refining degree effect

The increase in tensile index tends to reach a plateau (Figure 2a), as well as the decrease on specific volume, regardless the addition of starch. It can be observed in Figure 2b that, given a refining degree, the addition of starch results in paper sheets with higher tensile index. Nevertheless, the addition of starch slightly affects the specific volume.

The starch dosage used (1 % dry basis) was effective for tissue papers, since it allowed the formation of paper with higher tensile index without reducing specific volume (Figure 3).

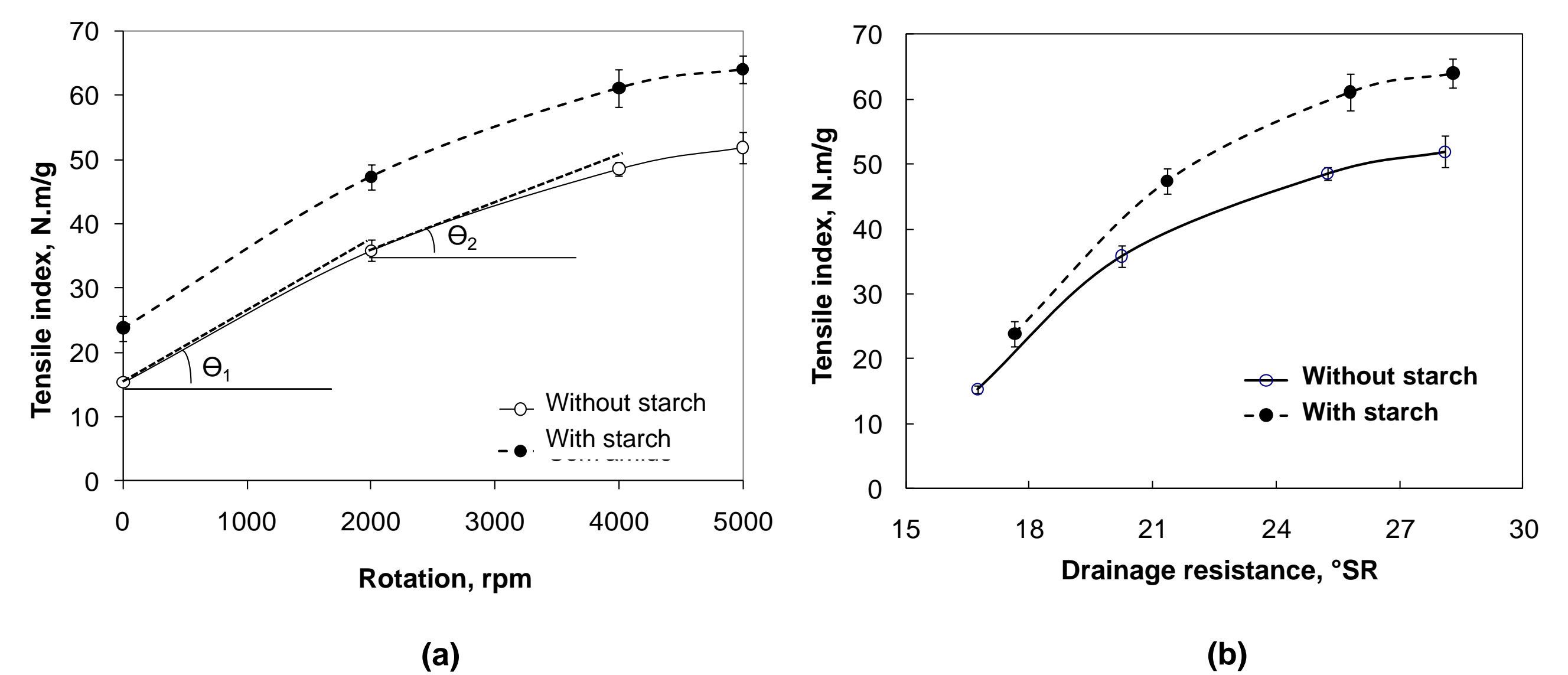


Figure 2. a) Effect of refining degree on tensile index, with and without starch; b) Effect of starch on drainage resistance along refining curve.

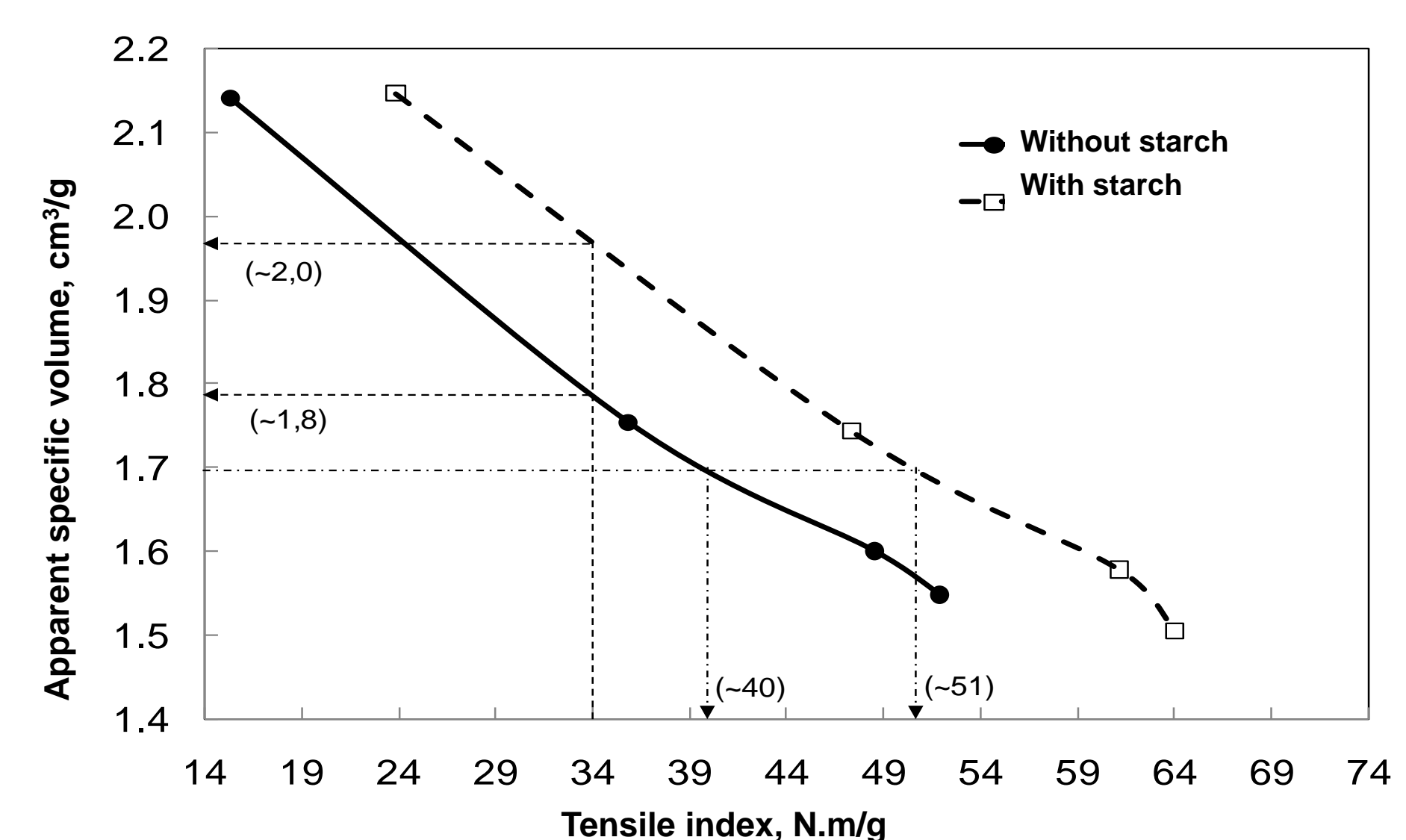


Figure 3. Apparent specific volume versus tensile index, for paper sheets with and without starch.

Starch dosage effect

It was observed an increase on tensile index and a decrease on specific volume, both significant until a starch dosage of 3 %, after which a plateau is reached (Figure 4).

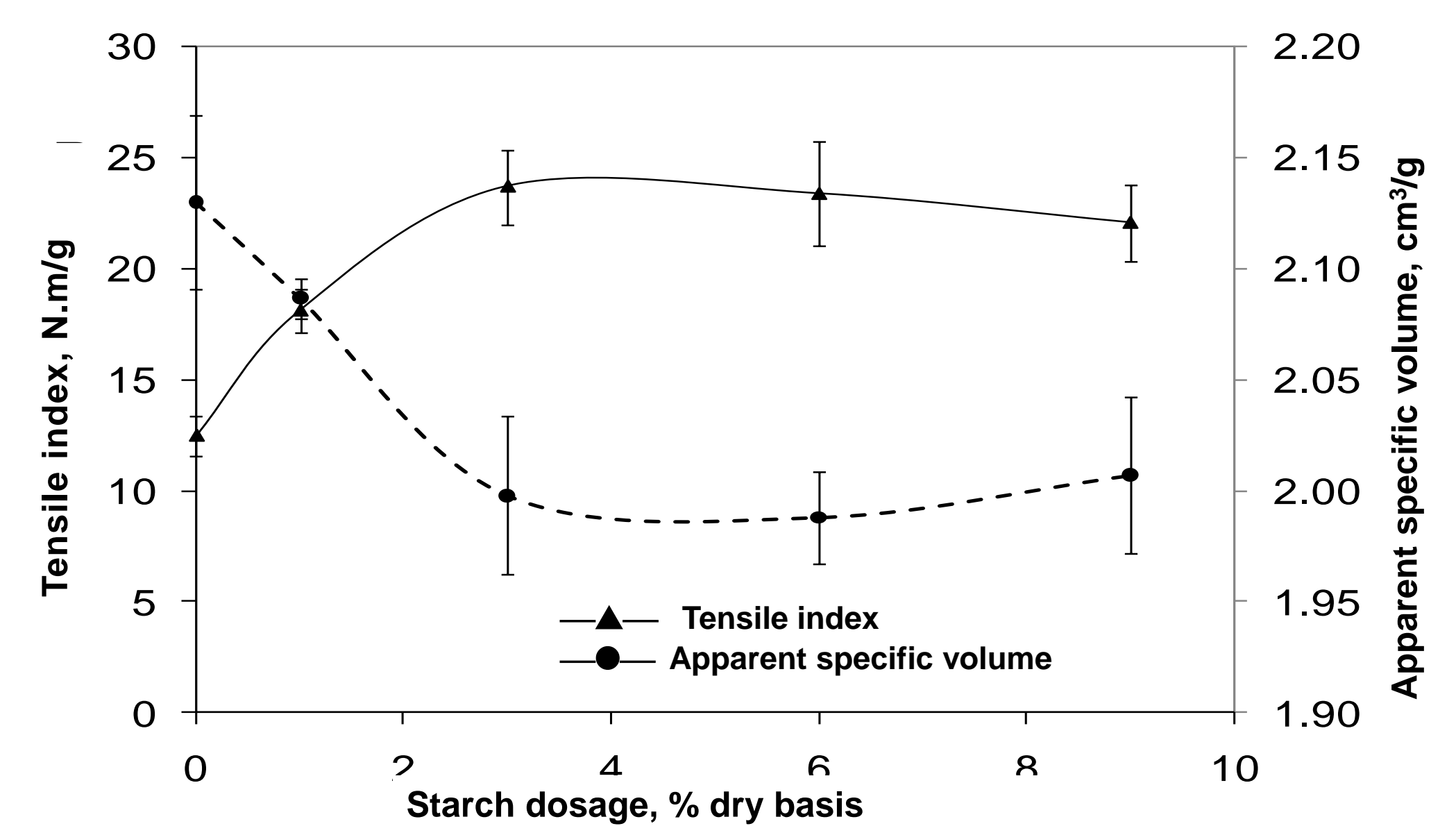


Figure 4. Effect of starch dosage on tensile index (primary Y axis) and on apparent specific volume (secondary Y axis).

CONCLUSION

Both refining and starch addition are alternatives to increase tensile index. In this work, starch addition was more favorable for tissue papers, because it increases the paper strength without compromising specific volume, property related to paper smoothness. The use of both alternatives together is a possibility to consider, specially to meet specific needs of tissue papers manufacturers.

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