CNF performance in recycled and deinked pulps: the role of fines

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Abstract

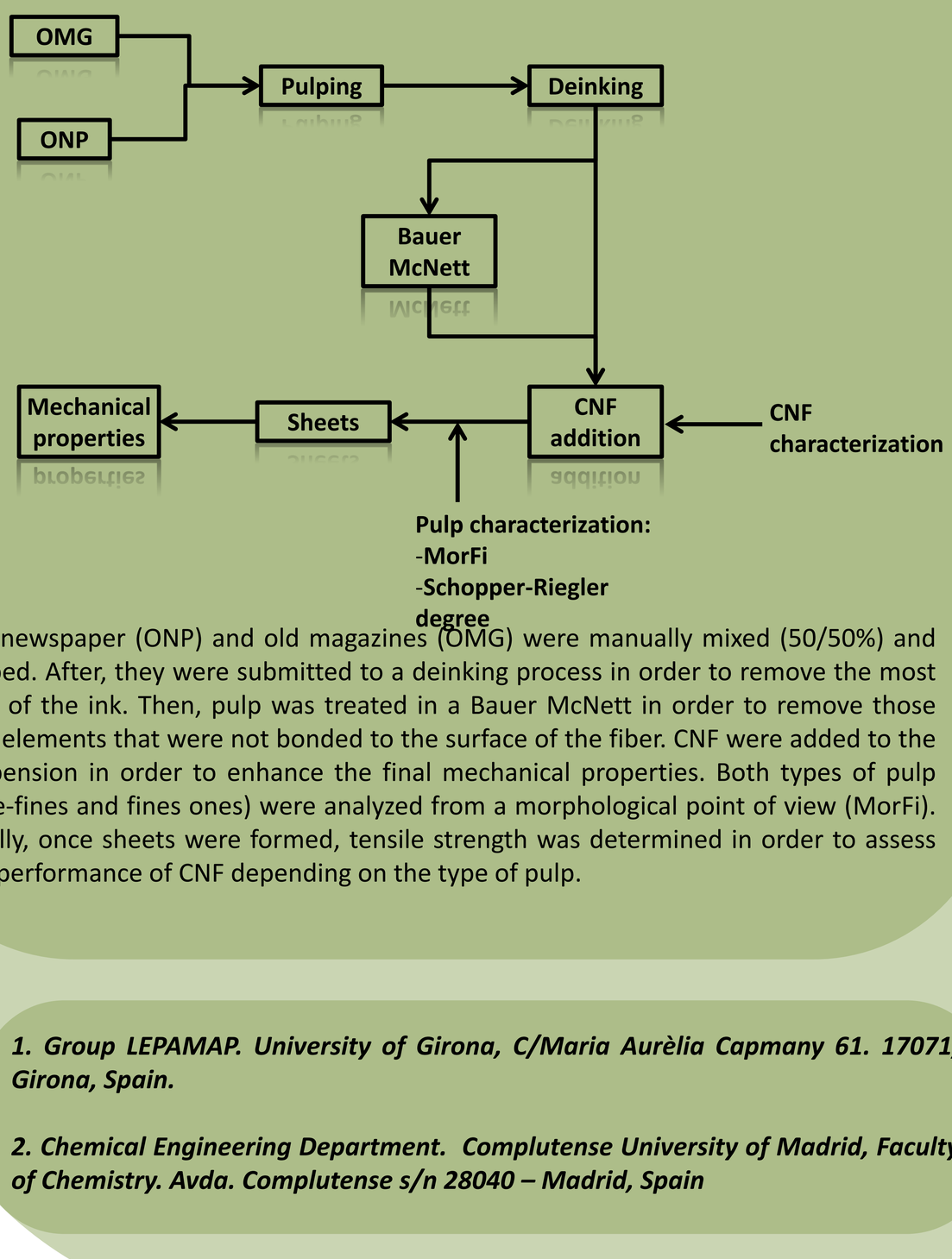
The activity of recycling waste paper will continue rising to really difficult levels to and reach. Too many recycling cycles deteriorates the fiber due to the hornification. Hubbe (2013) reported that depending on the quality of fine elements it is possible to enhance mechanical properties. In this case, old newspaper (ONP) and old magazines (OMG) are used as raw material to produce recycled and deinked paper. The quality of these fines is lower than that ones from virgin pulps. These fines contribute negatively to the increase of the drainage rate and they do not allow a good performance of CNF bonding with fibers. The present work aims to study the effect of the abovementioned fines with the addition of different percentages of fines. Pulps were characterized from a morphological point of view and paper was submitted to tensile strength test. It can be concluded that fines from recycled pulps do not contribute to the CNF retantion and, consequently, to the CNF bonding to the fibers.

Introduction

Too many recycling cycles make collected paper components not usable from a technical standpoint, and involve that recycling process after harvesting has diminishing performance. Nowadays every recycling cycle involve properties decreasing or a refining treatment for attempting to reach the commercial objectives. Hubbe (2013) reported that depending on the quality of fine elements it is possible to enhance mechanical properties. In the case of newspapers, these fine elements have a really low quality and it can affect directly to the performance of the CNF addition. The present work aims to compare the effect of CNF on free-fines pulps and on pulps containing the original fine elements.

Experimental

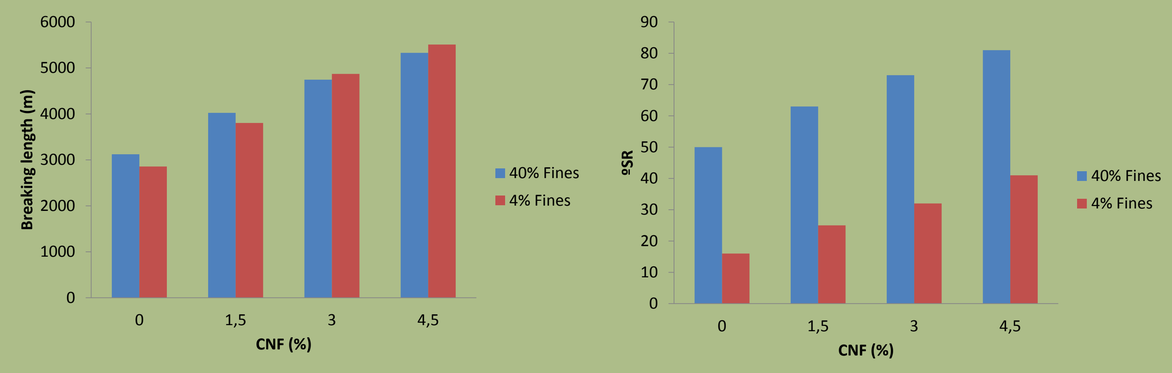
The following flowchart shows the experimental procedure of the whole project:



Old newspaper (ONP) and old magazines (OMG) were manually mixed (50/50%) and pulped. After, they were submitted to a deinking process in order to remove the most part of the ink. Then, pulp was treated in a Bauer McNett in order to remove those fine elements that were not bonded to the surface of the fiber. CNF were added to the suspension in order to enhance the final mechanical properties. Both types of pulp (free-fines and fines ones) were analyzed from a morphological point of view (MorFi). Finally, once sheets were formed, tensile strength was determined in order to assess the performance of CNF depending on the type of pulp.

Results and discussion

After the deinking process, the effect of fine elements in this type of recycled pulp was studied. Morover, the CNF effect to pulps with a fines high content towards pulps after a Bauer McNett stage was also studied. The following graphs show the pulp characterization (Schopper-Riegler degree and fines content) and the tensile resistance of paper (braking length).



The original suspension without fine elements presents a breaking length lower in a 9% relative to the original paper with fines. This low decrease is given by the removal of fines, which have a poor bonding ability compared to fines from virgin pulps. Comparatively, the performance of CNF on free-fines pulps is higher. When adding a 3% of CNF on deinked pulps (with fine elements), the increase is about 52%. On the other hand, if a 3% of CNF is added to the pulp that has been passed through the Bauer McNett, the increase is 70%. These differences denote the harmful role of fines over the mechanical properties when CNF are added. Moreover, it is clearly reflected that recycled fines are also harmful for the drainage rate, since while decreasing the fines content from 40% to 4%, it decreases from 50ºSR to 16ºSR.

Conclusions

The main conclusions of this work are the following:

- CNF have a better performance when they are added to a pulp free of fines, in the case of recycled and deinked pulp made of ONP and OMG.
- Fine elements from the suspension without CNF have poor ability to bond fibers, since there is a 9% decrease when they are removed from the original suspension.
- Recycled fines do not have the ability to bond to the macrofiber because of the hornification process that they have been submitted. Consequently, all the CNF bonded to them, will not get fixed in the paper web.
- In both cases, the addition of CNF increases the drainage rate due their specific surface.

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