

Influence of temperature on Bendtsen air permeability

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Abstract: Influence of temperature on Bendtsen air permeability. This work presents the impact of drying temperature and drying time on the air permeability properties of Bendtsen method on the final product. With the obtained results show that the air-dry pulp has a higher values of air permeability of the dried pulp. Furthermore, it shows that by drying the pulp occurs hornification and flexibility of fibre had been declining. However, even as a result of the refining process original features of fibre can not obtain the retained.

Keywords: drying, air permeability, hornification, temperature

INTRODUCTION

One of the fundamental process operations in the production of paper is drying. [1, 2, 3, 4, 5, 6]. In this process occurs hornification of fibers.[3, 4] The drying pulp disallows the swelling of the fibers which results in an decrease in their elasticity and flexibility.[1, 2, 3, 4, 5, 6, 7] These three properties play the most important role in the refining process so as to obtain paper of desired properties. This work is decided to investigate the effect of temperature on air permeability. These has to deepen the knowledge in this area. In the refining process can be seen that there are still many unexplored issues in this respect. One of the is the effect of drying on are refining process pulp. In the future this may entailed the application of the results to increase knowledge upon strength properties the final product made to varying degrees drying. Methodology was detailed developed for this problem in the work. In the experimental part also tested the properties of pulp and paper, which were subjected to drying before refining process. However, in this work it is shown only aspect of the influence of drying temperature on the air permeability. Based on these results it can be concluded that the drying plays an important role in the process of refining pulp. It was confirmed in a scientific manner that altering non-dried pulp is the best of pulp during papermaking process.

METHODS/ MATERIALS

The research material used in the work was bleached pine sulfate pulp in form of sheets of dryness equal to 93%. Equal amounts of pulp were dried at two temperatures of 105°C and 130°C for a period 1h and 150h. Refining curve was examined for each of dried pulp. In the pulp curves properties for different times of refining in PFI mill were investigated. A single batch was 22.5 g of bone-dry pulp and concentration was equal to 10%. On one point of execution three batches of the PFI mill were prepared. On PFI mill was performed refining ranging from 1min to 5min, refining in increments of 1min (with point 3,5 min). 1min is 1440

rpm in PFI mill. Before refining pulp was soaked in water for 24 hours. It was also examined time 0min for the pulp, the pulp was only process of defibering. After defibering and refining pulp was placed in mixers. After unification of pulp by mixing, concentrations were determined by execution of trial sheets on the Rapid Koethen type apparatus. The sheets were made according to PN-EN 20187:2000.

The following pulp properties research were performed like: water retention value, length, fines content, sliminess.

After performing test sheets, they were conditioned for 24 hours in standard conditions ($23 \pm 1^\circ\text{C}$ and $50 \pm 2\%$ relative humidity). The basic properties of the paper were performed such as: breaking length, tear resistance, roughness, air permeability, etc.

Examination of air permeability is the use of Bendtsen Roughness and Air Permeance Tester. This tester is an advanced microprocessor-controlled instrument for measuring the roughness and air permeance of paper and board using the Bendtsen method. Thy meets norms: ISO 5636/8791/2, BS 4420, DIN 53108/53120, SCAN P21. The range is of 0-5000 ml per minute.

RESULT

The following tables present results obtained during measurements.

Table 1. Table of air permeability of paper performed with air-dry pulp and dry pulp in temperature 105°C

Time refining	Air-dry pulp	Pulp dry in 105°C by 1h	Pulp dry in 105°C by 150h
[min]	ml/min	ml/min	ml/min
0	above scale	above scale	above scale
1	3750	above scale	4525
2	1000	960	1300
3	420	390	425
3,5	260	175	310
4	180	130	205
5	80	35	72

Table 2.Table of air permeability of paper performed with air-dry pulp and dry pulp in temperature 130°C

Time refining	Air-dry pulp	Pulp dry in 130°C by 1h	Pulp dry in 130°C by 150h
[min]	ml/min	ml/min	ml/min
0	above scale	above scale	above scale
1	3750	3620	above scale
2	1000	1080	3400
3	420	335	1080
3,5	260	210	540
4	180	134	332
5	80	44	65

CONCLUSIONS:

Drying of pulp at 105°C does not significantly affect the air permeability of paper. However very significant changes in properties of paper were observed for pulp dried at 130°C for 150h.

Drying of the pulp for 1 hour does not affect air permeability. It is too short drying time in order to change properties of pulp.

Drying of pulp at 130°C shows that the fibers become more rigid and less decompose, thereby increasing the air permeability.

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Streszczenie: „*Wpływ temperatury na przepuszczalność powietrza metodą Bendtsen*”. W pracy przedstawiono wpływ temperatury i czasu suszenia na przepuszczalność powietrza metodą Bendtsen na produkt końcowy. Z otrzymanych rezultatów wynika, że masa włóknista po suszeniu wykazuje większą właściwość przepuszczalności powietrza. Dodatkowo wykazuje, że w wyniku suszenia masy występuje rogowacenie i spadek elastyczności włókien. Niemniej jednak nawet w wyniku procesu mielenia nie można uzyskać oryginalnych właściwości włókien.

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