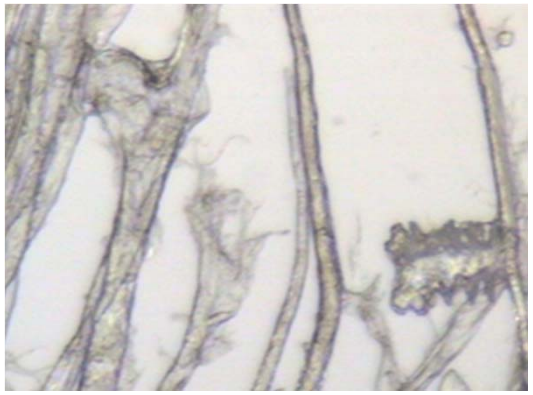
Determination of the Specific Fibre Weight of Pulp Fibres



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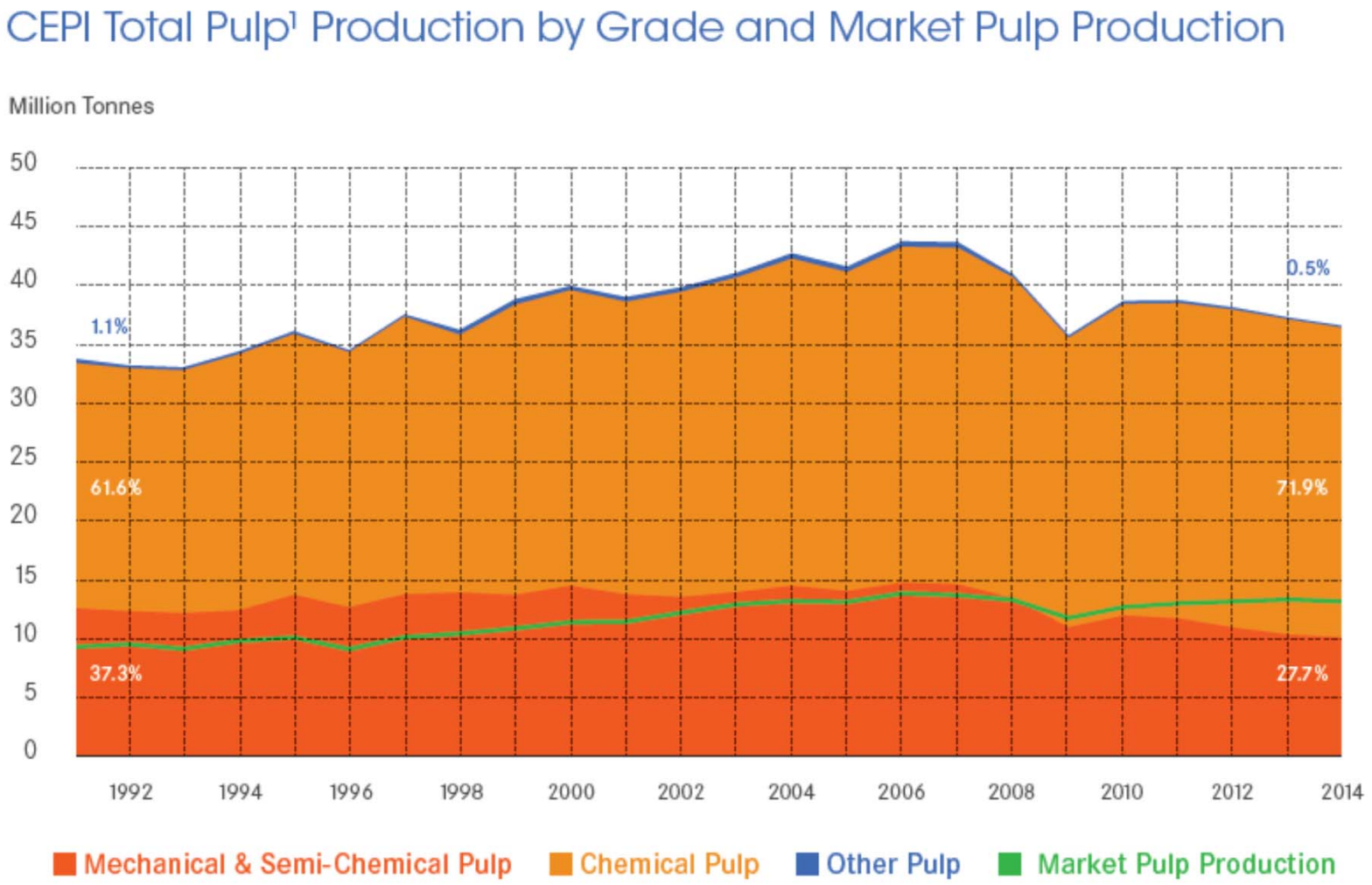
Abstract

- **Paper** is a three-dimensional **network** consisting primarily of primary and secondary **fibres**.
- **Primary fibres** are obtained **directly from plant** raw materials, mainly from wood and annual non-wood plants.
- **Secondary fibres** are produced from **recovered paper.**

Abstract

- The **technological processes** of the **pulp and paper producing** cause the **change** of *the length and surface of* the cellulose **fibres** with a different order of magnitude.
- **Fibre length** is a **fundamental property** of pulp.
- The **determination** of the **fibre length** and surface character of pulp fibres **is important** in papermaking technology and environmental protection as well.
- The **mass and the strengths** of the produced **paper** are characterized by those of the included **single fibres**.

Pulp Production



Scientific Work

- New method has been elaborated for **measuring** the **mass** of cellulosic **single fibres of different origin** and of different **pre-treatments**.
- The **number of single fibres** in a known amount of pulp fibres has been measured in an aqueous suspension for this purpose.
- The measurement has been fulfilled in **a Kajaani FS 100 fibre length analyser**.

Materials

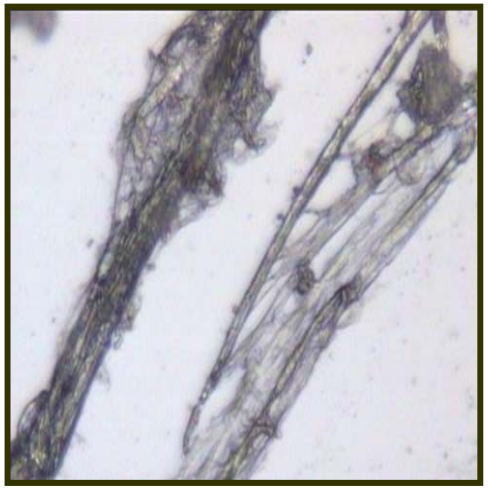
- **sulphate pine cellulose:**
  - bleached/unbleached
    - dried/undried

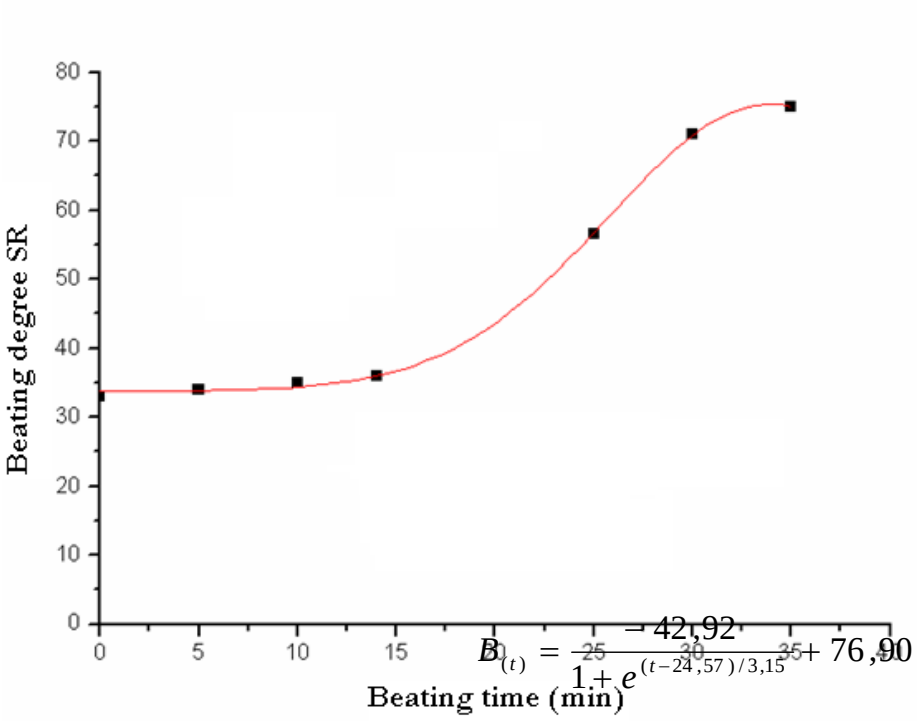
- **semi-chemical pulp**
  mixed hardwood
    - dried/undried

- **hardwood cellulose:**
  - bleachedand and dried

- **CTMP pine:**
    - dried/undried

Refining (beating)

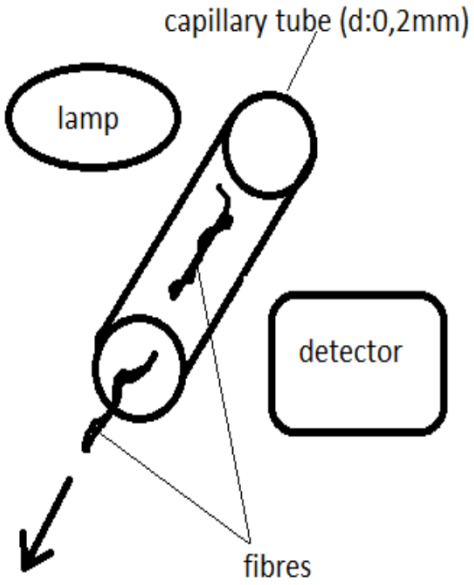




- Jokro mill
- FPI mill
- Bauer McNett fractions

Equipment

- **Kajaani FS 100 fibre length analyser**
- The main part of the device a capillary tube (0,2 mm) through which the thin suspension of the fibres is conducted.
- **On the one side** of the capillary is positioned a **lamp** and on the other, **opposite side is a detector**.
- When a fibre go through the capillary, the polarized picture of the single fibre is transmitted into the detector and from this we can calculate the length of the fibre.



Elaborated method

- 1. Determination of the **dry matter content** of the sample
- 2. Cellulose sample with 0.1-0.2 g absolute dry fibre content should be **pulped in 1000 ml distilled water**
- 3. **100 ml** of the above mentioned suspension should be **diluted to 1000 ml** by distilled water.
- 4. 100 ml of the suspension should be filled into the Kajaani 100 fibre analyser to determine the ***average fibre length*** ($\mathbf{l_{af}}$) and the ***total number of the included fibres*** **(tn)**.

Calculating

- ***Average single fibre mass*** ($\mathbf{m_{asf}}$) can be calculated by dividing the included ***mass of the fibres*** ($\mathbf{m_f}$) by their above gained number (tn):

$$m_{asf}\,(g) = m_{af}\,(g) / tn$$

- The above discussed data enable the calculation of the ***specific mass*** ($\mathbf{m_{spec)}}$ in g/mm of the single fibre:

$$m_{spec}\,(g/mm) = m_{asf}\,(g) / l_{af}\,(mm)$$

Average fibre length and specific fibre weight

Bleached undried sulphate pine ground in a PFI mill			
Freeness	Fibre length	Fibre weight	Specific fibre weight
SR°	mm	µg	µg/mm
13	2,27	0,303	0,133
22	2,26	0,298	0,131
33	2,23	0,295	0,132
47	2,21	0,295	0,133
57	2,19	0,289	0,131

Changes in average fibre mass, average fibre length and specific fibre mass of undried pine sulphate cellulose single fibre

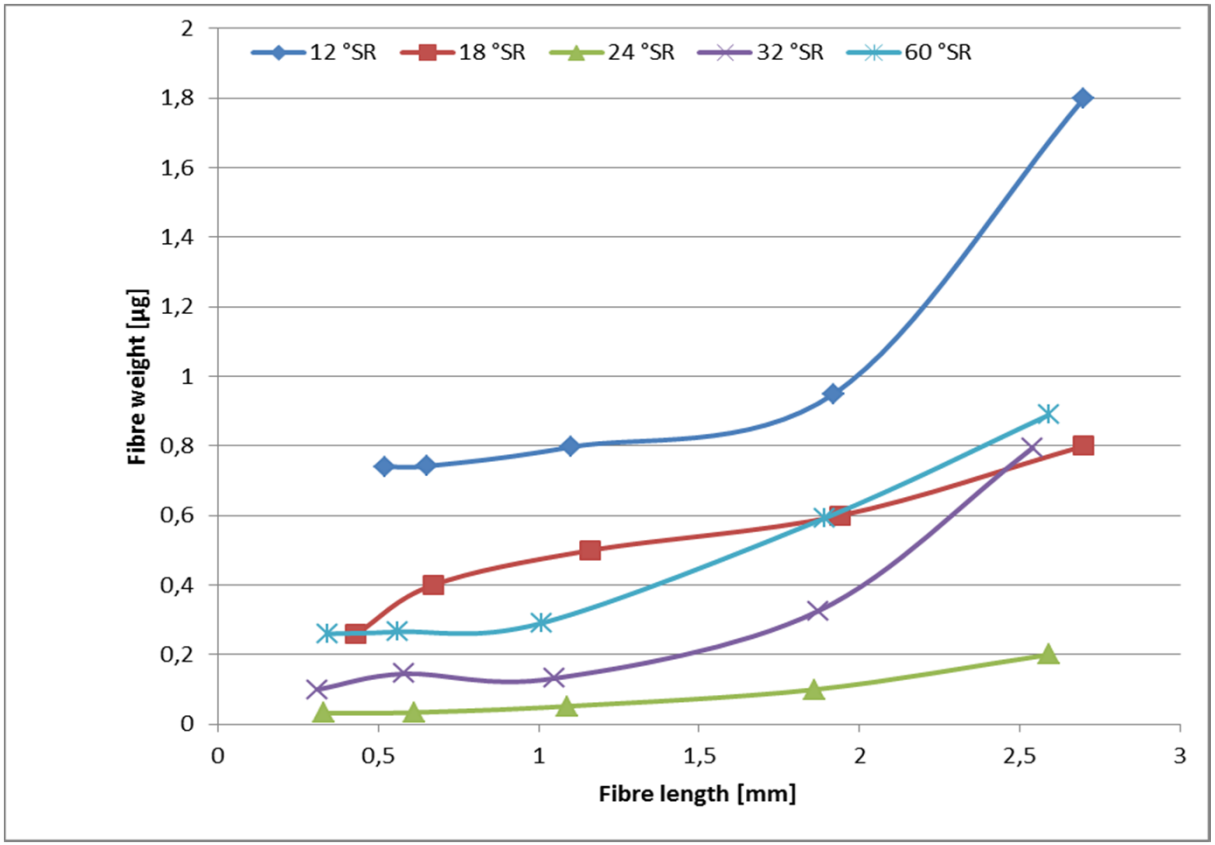
Bauer McNett fractions

- Average fibre length and mass of ECF bleached pine fibres of 5 different freeness (after grinding in Jokro mill) and 5 Bauer McNett fractions of each freeness.

Finnish bleached pine fibres of different freeness ground in a Jokro mill			
Bauer McNett fractions	Freeness	Fibre length	Fibre weiht
	°SR	mm	µg
14	12	2,7	1,8
30		1,92	0,95
50		1,1	0,797
100		0,65	0,742
200		0,52	0,741
14	60	2,59	0,889
30		1,89	0,592
50		1,01	0,291
100		0,56	0,266
200		0,34	0,26

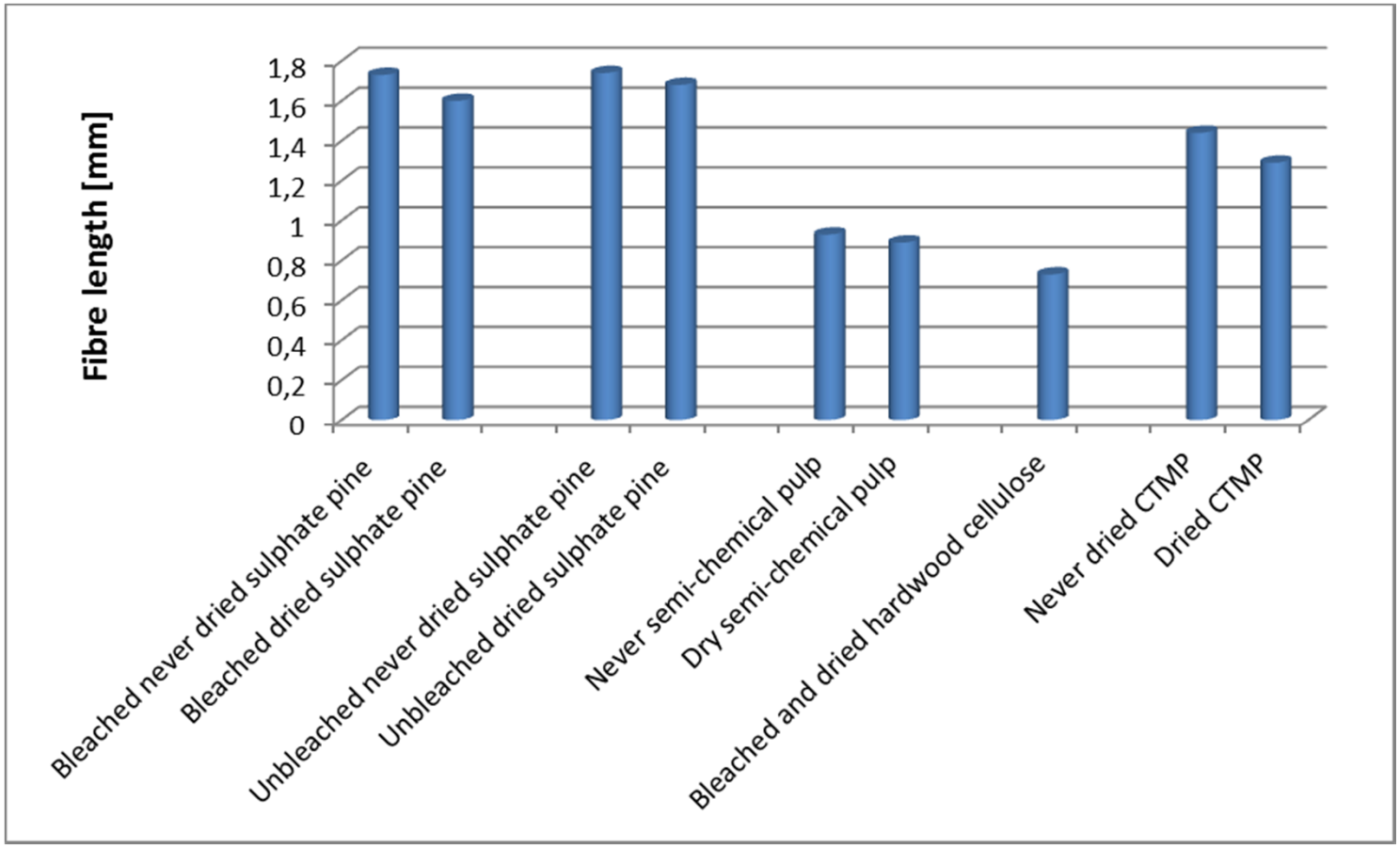
The first observation from the obtained data is that the grinding practically **does not decrease the average length of single fibres** but it is significantly decreases their mass.

Bauer McNett fractions



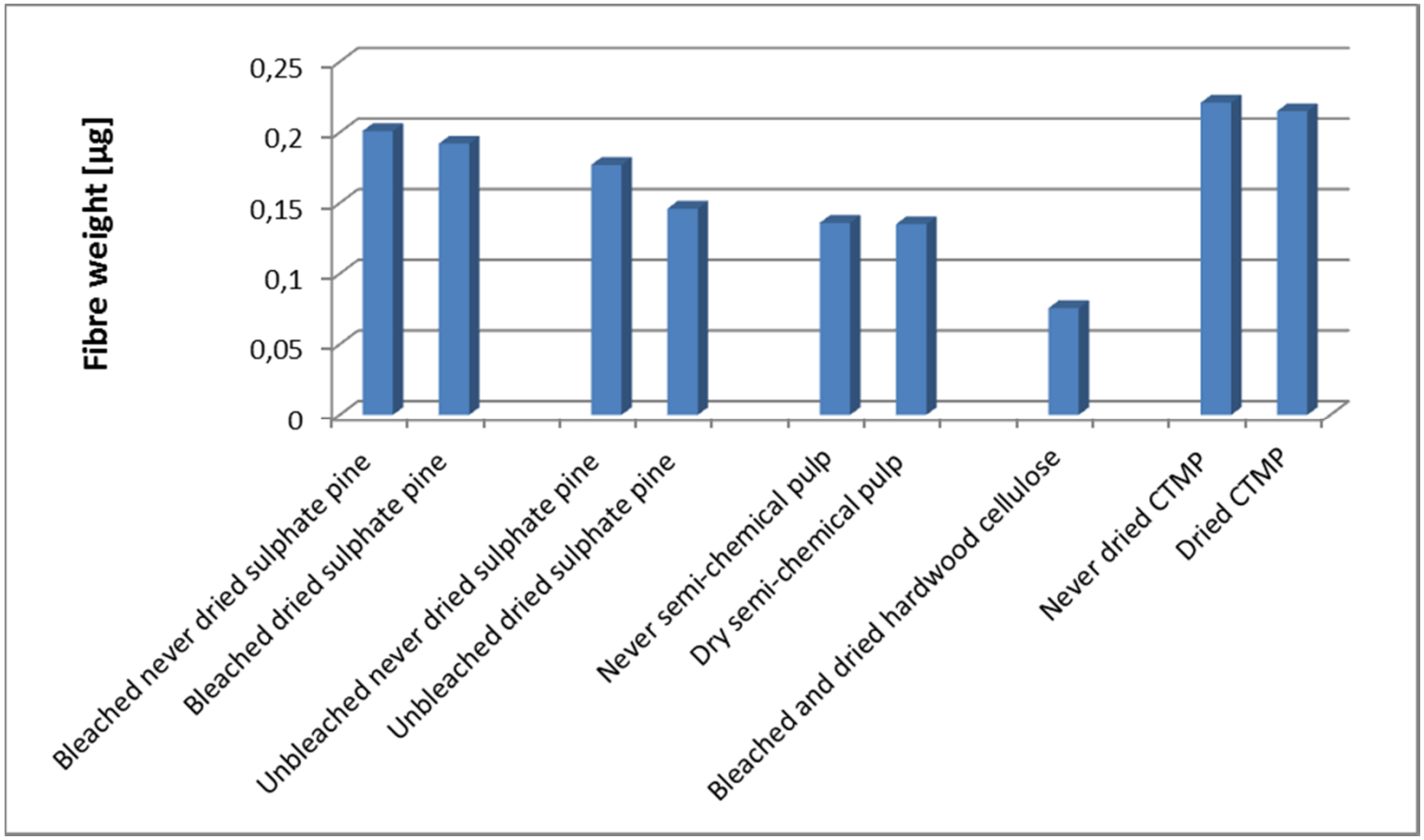
Average fibre length and mass of ECF bleached pine fibres of 5 different freeness and 5 Bauer McNett fractions of each freeness.

Average fibre length of cellulose single fibre of different origin at the 50 SR°



Comparing the **average fibre length** could be concluded that the **unbleached undried pine sulphate cellulose has the highest value and the bleached hardwood cellulose has the lowest one.**

Average fibre weight



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THANK YOU FOR THE ATTENTION