**Task 7 – Whiteness measurement**

**Aim**: **Whiteness measurement according to CIE Whiteness WCIE and TAPPI (T525 Brightness).**

1. Calibrate a spectrophotometer Datacolor SpectraFlash SF600 with specular component excluded (SCE) and with large aperture. Leave the UV amount set to 83,6 % using an inverse Ganz-Grisser calibration (amount set using a UV filter with upper passband of 400 nm and Hohenstein standards).
2. Measure all samples. Measure each sample 5 times, rotate it 90° each time. After measuring samples, write down the values of TAPPI, WCIE and tint values TCIE. After finish measurements on the first spectrophotometer, move to the next spectrophotometer to measure samples.
3. Calibrate a spectrophotometer Datacolor SpectraFlash SF300 with specular component excluded (SCE) and with large aperture. The amount of UV content is not specified for this spectrophotometer.
4. Measure all samples again. After measuring, write down the values of TAPPI, WCIE and tint values TCIE. After finish measurements on the second spectrophotometer, move to the next spectrophotometer to measure samples.
5. Calibrate a spectrophotometer Datacolor SpectraFlash SF450 with specular component excluded (SCE) and with large aperture. When setting up, select the UV filter with upper passband of 420 nm.
6. Measure all samples and write down the values of TAPPI, WCIE and tint values TCIE.
7. The last instrument on which you will measure the samples is spectrophotometer Technibrite Model TB-1. On this spectrophotometer, you will measure the ISO brightness (brightness Y) values. The instrument is calibrated using a black trap with a velvet and white standard. Calibration will be done by a teacher. All samples measure 10 times and calculate the mean and the standard deviation.
8. Make three plots.
9. **Plot 1** – Create a plot of the spectral reflectance factor $β\_{λ}$versus wavelength $λ$ for the **unbleached material** (**režný**) from the values given in the supplementary file at elearning.tul.cz for spectrophotometer SF600 and SF450 and determine the effect of amount of UV (amount UV filtration).
10. **Plot 2** – Create a plot of the spectral reflectance factor $β\_{λ}$versus wavelength $λ$ for the **bleached material** (**bělený**) from the values given in the supplementary file at elearning.tul.cz for spectrophotometer SF600 and SF450 and determine the effect of amount of UV (amount UV filtration).
11. **Plot 3** – Create a plot of the spectral reflectance factor $β\_{λ}$versus wavelength $λ$ for the **optical brightened material** (**OZP**) from the values given in the supplementary file at elearning.tul.cz for spectrophotometer SF600 and SF450 and determine the effect of amount of UV (amount UV filtration).
12. **For all plots, select the x-axis range to be 400 – 700 nm and the y-axis range to be 0 – 100 %.**
13. Prepare the protocol. Do a verbal evaluation of samples measured and the whiteness and tint. What effect does the use of a UV filter with upper passband of 420 nm have on the whiteness values?

In the log header, please include the title of the task, your name, the time and day of the practical, your field of study, and the year of study. In the prepared protocol, please indicate the laboratory conditions under which the assessment and measurements were carried out, as well as the instrumentation and tools used in the processing of the task.

In the protocols, follow standard text layout (block alignment, font size for main text 12 and headings 14 with bold).

**At the end of the protocol, answer the questions below and comment the results.**

**Laboratory conditions:**

**Instruments: spectrophotometer 1 –** Datacolor Spectraflash 450 with de:8°, 30 mm aperture, UV filter with upper passband of 420 nm

**spectrophotometer 2 –** Datacolor Spectraflash 600 with de:8°, 30 mm aperture, 83,6 % amount of UV

**spectrophotometer 3 –** Datacolor Spectraflash 300 with de:8°, 10 mm aperture

**Technibrite TB–1 –** d:0°

**Tools:** 6 samples – *unbleached, bleached, optically brightened, fluorescent, color and paper sample*

**Question:**

1. **List at least 5 equations for calculating whiteness and give their formula?**
2. **What is the range of tint according to Ganz and TCIE?**
3. **What is the range of whiteness values according to the WCIE?**
4. **Explain terms phosphorescence and fluorescence?**

**Table 1** – Results of whiteness and tint

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| --- | --- | --- | --- |
| **Name** | **SF600 (UV 83,6 %)** | **SF300****(not specified)** | **SF450 (FL42)** |
| **WCIE** | **TCIE** | **TAPPI** | **WCIE** | **TCIE** | **TAPPI** | **WCIE** | **TCIE** | **TAPPI** |
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**Table 2** – Results of brightness

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| **Name** | **Technibrite TB–1** |
| **M1** | **M2** | **M3** | **M4** | **M5** | **M6** | **M7** | **M8** | **M9** | **M10** | **Mean** | **SD** |
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