

Teacher's Feedback: CHEM-E1160 Biomass Pretreatment and Fractionation - in Laboratory

Course facts: Teaching periods III-V (2020); number of students 11 (all passed the course, grades 4 and 5); link to MyCourses: <https://mycourses.aalto.fi/course/view.php?id=24155>.

Teaching and learning methods: Lectures, workshops, laboratory exercise, presentations. Lectures, workshops, and presentations partially given online. Dr. Jaana Suviniitty from Aalto Design Factory (ADF) cooperated in planning, and partially executing, the teaching. Some parts of the teaching were carried out at ADF. Also Metsä Fibre Oy was participating in teaching (Katariina Kemppainen as the contact person), and the bark and wood raw materials were obtained from the company. In the beginning, two teams (5 and 6 students/team) were formed: one working with utilization of softwood bark and the other one testing a novel process for extracting lignin from birch chips. The "story" in this project course was that the teams were start-up companies who were to create process concepts to be realised as a part of Metsä Fibre's Äänekoski bioproduct mill's ecosystem. Firstly, the students planned their process concepts, and secondly the concept was tested in the laboratory environment. As the Äänekoski mill uses the kraft process for wood fractionation, kraft and soda pulping experiments were executed in the laboratory. The laboratory experiments were carried out by methods and equipment available at the Department (air-bath digester, kappa number & viscosity determination, O₂ delignification, as well as O₃ and peroxide bleaching etc.), instructed by KR and Ph.D. and post. doc. students. Due to the unfortunate and rapid evolution of the COVID-19 pandemic, not all planned laboratory experiments could be carried out; therefore, the students had to use literature results quite extensively in reporting the results. The student teams reported their results in many different ways, both orally (in class, as well as online) and in written form. In addition, the students gave feedback on each other's work with the *I like, I wish* method developed at ADF.

Assessment methods: The student teams produced various written documents during the course: Project and Production Plan, Laboratory Report, and Project Report. These accounted for 20%, 40%, and 40%, respectively, of the final grade. The students carried out self and peer evaluation of the team members' input in the team work and based on this, a personal coefficient was calculated for each student. The coefficient's impact on the student's personal grade was limited to ± 1 grade point.

Feedback summary: The average values of the numerical data in the Webropol survey are displayed in Table 1.

Table 1. Average values of the numerical feedback given by the students in 2020 and 2019. The column "Min.-Max." indicates the deviation. Number of respondents: n=6 (2020); n=7 (2019).

	Aver. 2020	Min.-Max.	Aver. 2019	Min.-Max.
1. Overall assessment	4.00	3-5	4.14	4-5
2. Teaching methods	4.50	4-5	4.71	4-5
3. I am pleased with my study effort	4.33	4-5	5.00	5
4. Workload compared to other courses	3.50	3-4	4.14	3-5
5. Correspondence to the description	3.83	3-4	4.43	4-5
6. Effect on the study motivation	3.83	3-5	4.14	3-5
7. Difficulty compared to other courses	3.33	3-4	3.83	3-4 [*]
8. The course enhanced my general skills	4.17	4-5	4.67 ^(†)	4-5

^{*})One respondent chose E=Not applicable.

[†])n=6

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Feedback was collected both by group discussion (11 replies) with the students and by the standard electronic survey (6 replies; Webropol). Summary of the positive aspects mentioned by the students: laboratory work; working in (small) groups; course format: project work and independent planning; collaboration with Metsä.

Summary of the things to develop according to the students: clearer communication and planning of the schedule; too many teaching sessions; Metsä should be involved more, *e.g.* a boot camp/brainstorming together with the company.

Development actions for next year: I will enhance planning of the lab work schedule and communicate it more clearly to the students; because this is a recurring complaint by the students, I finally have to make a real effort to improve this aspect! Most probably the collaboration with Metsä will continue – I am currently waiting for the company's reply on this. I feel that the idea about brainstorming together with the company is very good, and I will suggest that as a working method to Metsä.

General feedback from the teacher: Again, it was a pleasure to teach this course: big thanks to the students and to my teaching colleagues! The students were extremely motivated and hard-working, and although this seems to be case every year, somehow "the class of 2020" felt special in this respect. The very good atmosphere and excellent collaboration within the student teams was evident throughout the course. Therefore, it was indeed a pity that we had to prematurely stop working in the lab: the teams would have deserved to obtain all the results from their laboratory experiments. The collaboration with Metsä Fibre was also a very positive experience and I will make an effort to continue it.