

# OPPONENT'S REVIEW

## of PhD. dissertation thesis

**Author:** Ing. Lukáš Münster

**Title:** Dialdehyde cellulose preparation, characterization and utilization as crosslinking agent for PVA

**Opponent:** prof. Ing. Pavol Alexy, PhD.

The submitted thesis is focused on the preparation, characterization and application testing of dialdehyde cellulose as bio-based crosslinking agent for PVA hydrogels preparation. The work has a range of 144 pages of text, tables and images, including 181 references. The literature sources are well chosen and appropriately used, both in terms of setting the objectives of the work, as well as in terms of choosing the experimental preparation process of the materials and their characterization. The work is appropriately divided into separate chapters, written in clear manner. The main focus is on the preparation and characterization of dialdehyde cellulose with respect to their stability against ageing.

Results of the thesis are based on a lot of experimental work, very precisely chosen analytical methods and testing. All obtained results are logically discussed in detail with confrontation to known knowledge from literature. Although the dissertation thesis is of a very high level of quality (in its content as well as the formal processing). I have the following comments/questions:

1. In the pilot study part of work the author concluded (based on his own experiments) that some part of crosslinking of PVA originated in PVA degradation at higher temperature and lower pH. This observation is in coincidence with very well known behaviour of PVA. These effects were observed on macroscopic observations as well as on network parameters from swelling experiments. Is it possible to determine which part of cross bonds originated in PVA – PVA cross bonds (due to degradation process) and which part is represented by crosslinking via the dialdehyde cellulose?
2. There were two commercial grades of PVA chosen for the crosslinking experiment. Most of the experiments were done using PVA Mowiflex. This material, in contrast to Mowiol, is not pure PVA, but it is the PVA based blend containing also plasticisers, preferably glycerol. What was the main reason to do practically all experiments with this type of PVA?

3. According to my opinion, the glycerol OH groups can react with aldehyde groups and therefore the crosslinking efficiency (positively as well as negatively) can be influenced by glycerol concentration in PVA. In addition, the fact that glycerol contains three OH groups in its molecule, also gel formation based on aldehyde cellulose and glycerol without PVA participation can be theoretically created. Were these aspects taken in consideration? What concentration of glycerol was in Mowiflex? Does Mowiflex also contain other additives, apart from glycerol, which can have influence on chemical reactions between PVA and dialdehyde?

The presented dissertation thesis of **Ing. Lukáš Münster** represents valuable results with high level quality interpretation . The objectives of the dissertation were fulfilled and the work meets the criteria for a doctoral study. Based on this, after a successful defence, I suggest **Ing. Lukáš Münster** to be awarded with the title

„philosophiae doctor“, PhD.

Bratislava, 9.8.2018

Prof. Ing. Pavol Alexy, PhD.