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Thesis Opponent Review:

„*Study of properties of biodegradable polymeric materials based on polyester*“

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Course: 2808V006 Technology of Macromolecular Compounds

Program: P 2808 Chemistry and Materials Technology

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To whom it may concern,

The dissertation thesis submitted presents the influence of different parameters such as molecular weight, shape of samples and history of treatment on biotic degradation of two types of polyesters namely polylactide and poly(butylene adipate-co-terephthalate). Second part is dedicated to the application of microparticles based on the same type of polyesters as a carrier for bioactive compounds.

The presented thesis was prepared based on 6 papers, 2 CC already published articles, 1 publication draft and 3 conference proceedings, which form the main body of the thesis. Some theoretical background related to the properties and biological degradation of both types of polyester is also included. Presented theoretical background is concise and is according to my opinion too general and trivial. On the other hand more focused state of the art related to the particular problem is described in particular papers. However, this part of the thesis does not act comprehensively. The objectives of the thesis are clearly described and are related to the presented papers. In addition to papers, shortly discussed results and conclusions are also included in the main body of the thesis. Conclusions logically follow the objectives. Maybe few sentences discussing mutual features of biodegradation of PLA and PBAT could be written in the conclusion.

There are some other comments I would like to make:

- Page 16-PLA properties - It should be pointed out that from 3 optically pure dilactides (L,L-; D,L- and D,D-) it is possible to prepare by ROP semicrystalline polymer, isotactic PLLA or PDLA and also syndiotactic PDLLA. Only atactic PDLLA is amorphous.
- Paper I: In abiotic degradation (hydrolytic) processes one of the main roles play crystallinity of polymer material in most cases. In this paper, no thermal characteristics about investigated material were shown in experimental part nor discussed. What role does play the extent of crystallinity in condition of biodegradation? It is well known, that accessibility of ester bond to the enzymes and/or water is increased with mobility of chains. Thus the temperatures as T_g and T_m as well as % of crystallinity of materials should be important.
- Paper II: 1. What type of PLA did you use, semicrystalline PLLA or amorphous PDLLA?
2. In Figure 5C are presented different behaviours of 10 h irradiated films with those 50 h irradiated. Why sample 10HF had slower biodegradation as that 0HF? In addition why sample 10HS had quickest biodegradation as that 50HS? I did not discern discussion to this observation in the text.
3. Could you explain closer words „*fragmentation of the agricultural films*“ in the conclusion part? In experimental part you described that biodegradation was performed with cutted 2 mm pieces of films. What extent of fragmentation you expect for agricultural foils?

- Paper IV: 1. In the experimental part-section Gel permeation chromatography, description of the instrument is well written, but description of the most important mobile phase is missing.
- 2. Could you explain, why in the case of high molecular weight PLA biodegradation reached only 50-60 % of mineralization (Figure 1-PLA3 and PLA 4, Figure 2A)? Is it question of time scale of experiment? In some cases the process profile evokes saturation in the later stage of this process (Figure 1-PLA 4, Figure 2B). One could expect gradual increasing of biodegradation with shortening of polymer chains accompanied by 100 % mineralization in all cases. Did you wait for full biodegradation at least for selected samples and what was the time profile of the process?
- 3. Page 91-last sentence of 3.2 Biodegradation of PLA samples in compost: I am not fully agree with an explanation concerning „*lower extent of free mobile chains*“. The mobility of chains in semicrystalline polymers are done by degree of crystallinity under assumption that chains in crystalline phase are not mobile at all. At the beginning of the paper you declared approximately similar degree of crystallinity X_c of all PLA (according to Table 1) even for PLA2 and PLA 3. This is in contradiction to your „mobility“ explanation. The quality and size of the crystals would play more important role in this process. PLAs with high T_m have bigger crystals. For this reason, thermal characteristic of precipitated PLA1/PLA4 mixture powders should also be included.

To sum up I do believe, that the presented thesis is at high level and extent to be considered as sufficient for PhD. Therefore I do recommend awarding Ing. Petr Stloukal the academic degree „**philosophiae doctor**“ (PhD) after his successful defence.

Mgr. Martin Danko, PhD