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Děkan

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**Object: Doctoral thesis review**

Title of the thesis: **Bioactive Polymeric Systems for Food and Medical Applications**

Name of PhD student: **MSc. Onon Otgonzul**

The presented thesis entitled "Bioactive polymeric systems for food and medical applications" was written out within the doctoral study program "Chemistry and food technology" by Onon Otgonzul. The thesis was elaborated in form of English written monograph consisting of 128 pages, 3 main chapters and other parts which are essential for such kind of work. The chapter 3 is subdivided in 3 parts as planning publications.

The reviewed thesis overviews the current state of art in the area of bioactive polymeric systems. The crucial attention is paid to the packaging technologies as it is revealed in the title of this work. More concretely, this work is dedicated to polymer blending description of the incompatible polyamide 6 (PA6) and biodegradable polymer based on co-polyester of polylactic acid, which is commercially available under the name "Bioflex".

Chapter 1 deals with theoretical introduction of bioactive polymeric systems. The relatively significant place is dedicated to introduction to advanced polymeric packaging materials such as biodegradable packaging and other systems showing certain type of biological response. The mass transport phenomenon is explained as well. The second sub-chapter reports about the polymer blending, compatibilization and morphology of polymer blends. The main attention is paid to co-continuous structure formation, which is supposed to ensure the desired bioactivity.

Chapter 2 introduces the materials and the methodology used during preparation of this work including mechanical, rheological, thermal, structural properties as well as release testing.

Chapter 3 represents experimental data and discussion of the results. It is logically divided into 3 subchapters. Each subchapter has character of manuscript-like text. The first subchapter describes the PA6/Bioflex blends preparation and characterization of their viscoelastic properties in molten state in correlation with morphology with the aim to find the PA6/BioFlex composition ration which can provide co-continuous morphology. In addition, this work also focuses on comparison of various empirical models, developed for co-continuous morphology formation prediction, with experimental data. Second subchapter is dedicated to investigation of the effect of morphological factors on mechanical and thermal properties of PA6/Bioflex polymer blends. The structural analysis is included as well. The final third subchapter represents the systematic study of a release ability of an incorporated model compound from PA6/BioFlex blends in dependence on the polymer blend morphology.

The theoretical part of the proposed thesis is organized logically and brings the background of the studied field in the sufficient range. The PhD applicant refers to almost 150 sources, which includes both fundamental publications and current works from the studied area.

The experimental part briefly describes the principles of the methods which were used for during the applicants PhD studies. Their range is relatively wide from polymer processing to the methods of analytical chemistry.

The division of the results and discussion section on three parts seems to be reasonable. The individual parts follow up in the sequence of preparation and characterization of the samples with different morphology, investigation of the effects of various morphologies on material properties and release kinetics of the selected model compound incorporated into the systems (crystal violet), respectively. It can be assumed that each chapter can be submitted for publication in a scientific journal after minor modifications.

It can be conclude that level of English language used in this thesis is sufficient. However, several mistyping and grammar errors can be found in the text. I give just a few examples of mistyping:  
chapter 1.1.1, page 10: ...vapours of low molecular weight molecules and not ...vapours and of low molecular weight molecules,  
chapter 1.1.2, page 16: the word "lysozyme" is missing in the text to show example of additive used with PVOH, literature 37; the same valid for the example with CTA, the word " naringinase" is missing,  
chapter 1.2, page 35: mistyping in authors order - literature 69,  
chapter 2.2., page 55: DMA belong to the group of methods for thermal analysis,  
chapter 3.1, page 65: "gap" and no "gab".

Suggestions:

1. Chapter 2.2 concerning the description of methodology was too broad; moreover it contains very basic theoretic knowledge. I suppose this subchapter for redundant part of dissertation work because the precise description of methodology (that is necessary) is given in Chapter 3.

Here are some questions concerning dissertation work:

- 1) Chapter 3.1., page 63: The mixture of PA6 with Bioflex after blending in Brabender chamber was pulverized or disintegrated?
- 2) Chapter 3.1, page 64: Is the formula (25) properly written?
- 3) Chapter 3.2, page 88: Why are data straight coupled if individual values do not lay on this straight line?
- 4) Please discuss the thermodynamical factors attending polymer compatibilization process.
- 5) Please discuss the meaning and importanacy of phase inversion occurrence.
- 6) Why the system of PA6 and BioFlex has been selected for the investigation?
- 7) The migratory and non-migratory systems are described in the theoretical part (subchapters 1.1.3 and 1.1.4). Into which group belong the systems studied in chapter 3.3, i.e. PA6/BioFlex/crystal violet?
- 8) What were the reasons to choose the crystal violet as a model compound?
- 9) Please explain the importance of release medium selection and the factors which can influence the release kinetics of a compound from a polymer matrix.

Finally, it can be summarized that reviewed PhD thesis fulfils all preconditions for its consideration as "acceptable". On the basis of that, I recommend MSc. Onon Otgonzul for awarding of PhD degree after successful defending of her work.

Sincerely yours,

Ing. Adriana Gregorova, PhD.

