

December 3, 2015

FROM: Stephen H. Foulger, Ph.D., Department of Materials Science and Engineering  
TO: Assoc. Ing. František Buňka, Ph.D., Dean, Faculty of Technology  
SUBJECT: Report on doctoral thesis submitted by Rushita Jaswant Shah to the Tomas Bata University in Zlín entitled:

“Biomaterialized and Stimuli Responsive Hydrogel for Biomedical Applications”

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Dear Dean Buňka,

The motivation for the doctoral research was driven by three opportunities that have not been fully addressed in the current literature that include: (1) mineralized hydrogels are in demand for biomedical applications because of their enhanced physical properties; (2) there is a limited number of methodologies for the production of a biomaterialized hydrogel; and (3) a calcite filled biomaterialized hydrogel scaffold had not been presented where mineralization of CaCO<sub>3</sub> had been done in a polyvinylpyrrolidone (PVP) and carboxymethylcellulose (CMC) hydrogel matrix. The focus of the doctoral work was motivated by these opportunities and specifically developed a biomaterialized hydrogel using a novel biomimetic mineralization technique. This biomaterialized hydrogel was chemically & mechanically characterized in the course of the studies, while its stimulus response and biomedical applications were explored. The presented Ph.D. doctoral thesis is composed of a collection of six articles, of which four (three published and one submitted) are published in ISI Journals while two are published in peer-reviewed international conference proceedings. The title of the publications and the dissemination points are listed below:

1. Preparation of CaCO<sub>3</sub>-based Biomaterialized Polyvinylpyrrolidone–Carboxymethylcellulose Hydrogels and their Viscoelastic Behavior (*Journal of Applied Polymer Science*)
2. Influence of Strain on Dynamic Viscoelastic Properties of Swelled (H<sub>2</sub>O) and Biomaterialized (CaCO<sub>3</sub>) PVP-CMC hydrogels (*Journal of Applied Rheology*)
3. Mineralized polymer composites as biogenic bone substitute Material (*AIP Conference Proceedings*)
4. Stimuli responsive and biomaterialized scaffold: an implant for bone-tissue engineering (*SPE ANTEC 2015*)
5. Influence of Temperature, pH and Simulated Biological Solutions on Swelling and Structural Properties of Biomaterialized (CaCO<sub>3</sub>) PVP-CMC Hydrogel (*Progress in Biomaterials*)
6. Properties of biomaterialized (CaCO<sub>3</sub>) PVP-CMC hydrogel with reference to the cytotoxicity test using fibroblasts cells (*International Polymeric Materials and Polymeric Biomaterials*)



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Clearly, the thesis, via the publications, has been peer reviewed and found sufficiently credible to be published in esteemed journals. Nonetheless, I have some specific comments on the actual thesis that are listed below.

Pg. 60 – “*For fulfilling the required goal, firstly focus was given to observe the change during the swelling behavior of biomineralized hydrogels in physiological solution.*” – What is this solution? Is it phosphate buffered saline (PBS)? The ionic concentrations of your solution must be very important in determining the swelling characteristics of the samples presents in Figure 21.

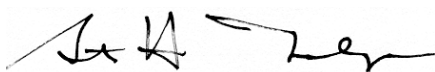
Pg. 62 – The figures could be more effective in presenting the scientific argument if the captions had more information on the experimental conditions. For example, Figure 22 should have sufficient information on how the solutions were prepared to swell the hydrogels without forcing the reader to refer back to the original papers in which the data was presented. I think this idea of including more information in the captions could be carried over to many of the figures in the thesis.

Pg. 64 – “*The results showed, the cell viability above 80% in all the extracts concentrations of hydrogels for all time of exposition, resulting the fact that all the samples (VII-X) were without any cytotoxic effect.*” – Is a 20% reduction in cell viability in 72 hours not considered toxic? It also appears that the reduction is more pronounced with higher “concentrations of extracts”. Is there a solid content for the 100% parent extract?

General observations – A number of general stylistic suggestions are documented throughout the manuscript that might help the flow of the prose.

These latter questions and comments do not deter from the scientific value of the thesis. The candidate has adequately demonstrated an expertise in the field of polymer science, as well as the ability to carry out independent and original research. Based on my observations of this thesis and accompanying published papers, I recommend the award of the Ph.D. degree to the candidate, Rushita Jaswant Shah , by Tomas Bata University in Zlín.

Best Regards,



Stephen H. Foulger  
Gregg-Graniteville Endowed Chair and Professor  
Departments of Materials Science and Engineering & Bioengineering  
Clemson University  
Clemson, SC 29634-0971

