A simple approach for the waterborne polybutylene succinate coated paper and their sustainable packaging applications

Dr. Syeda Shamila Hamdani, Jayesh Mestry & Dr. Muhammad Rabnawaz

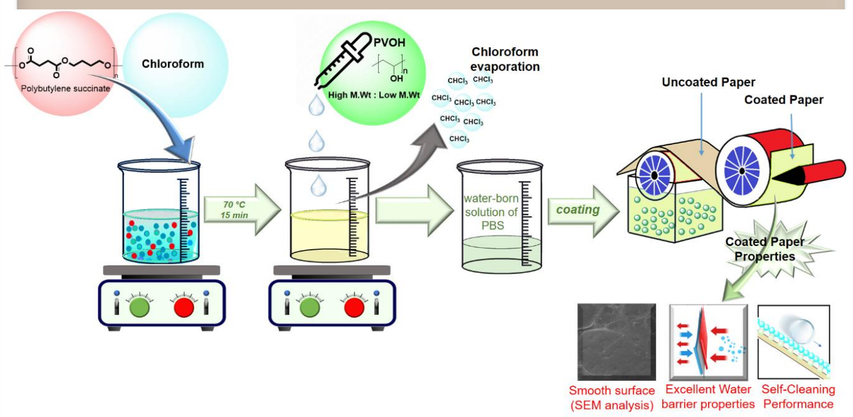
Email : hamdanis@msu.edu, mestryja@msu.edu & rabnawaz@msu.edu

School of Packaging, Michigan state University, 448 Wilson Road, east Lansing, Mi 48824-1223, USA

Introduction

Paper is a great replacement for single-use plastics due to its low-cost and biodegradable nature. However, due to its porous nature, paper substrates lack water and oil resistance in an unmodified form. To address this problem, different approaches are used to modify the surface energy and porosity of the paper in order to achieve water and oil-resistant paper product.[i-iii] Reported herein is waterborne polybutylene succinate (PBS)-coated paper as a 100% biodegradable packaging material. PBS is one of the few polymers that is inexpensive and fully biodegradable and thus was used to coat paper substrates in this study. The water and oil repellency, thermal sealing performance, and mechanical properties of these coatings were determined and compared with five commercial benchmarks

Methodology



Scheme 1. Development of Latex & fabrication of coated papers.

Sample Codes	HMW PVOH (%)	LMW PVOH (%)
Un-K	-	-
PBS-La-50/50-D	50	50
PBS-La-50/50-S	50	50
PBS-La-60/40-D	60	40
PBS-La-40/60-D	40	60

Table 1. Selected formulations and corresponding codes

Results & Discussion

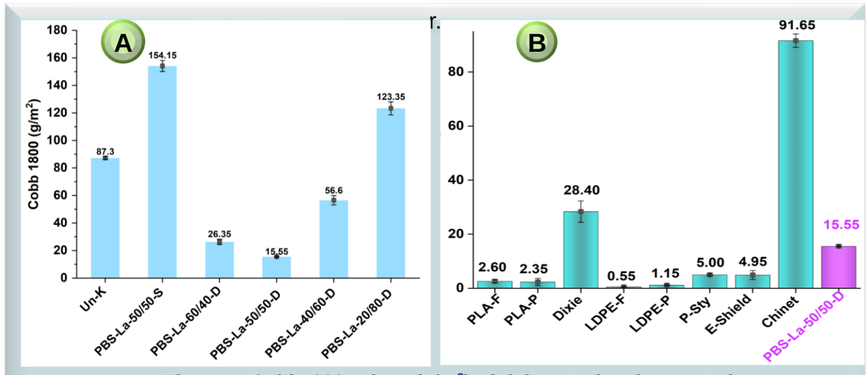


Figure 1. Cobb1800 values (g/m²) of (A) coated and uncoated paper samples (B) various controls

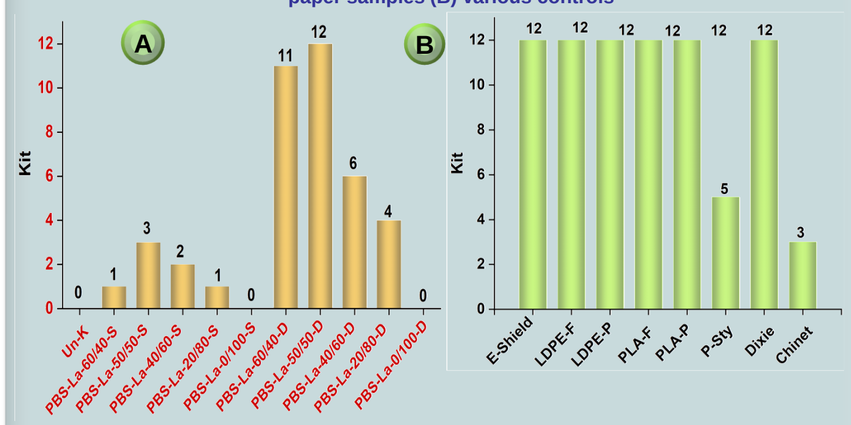


Figure 2. Kit ratings of the (A) uncoated & coated-paper samples and (B) of various commercial standards.

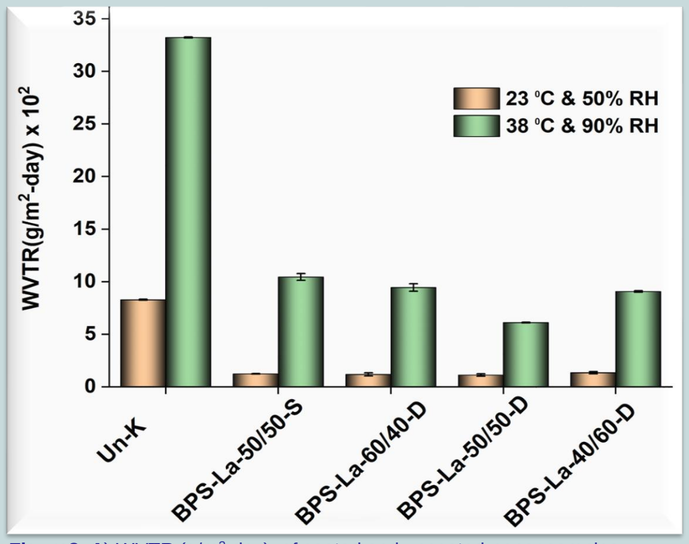


Figure3. A) WVTR (g/m²-day) of coated and uncoated-paper samples.

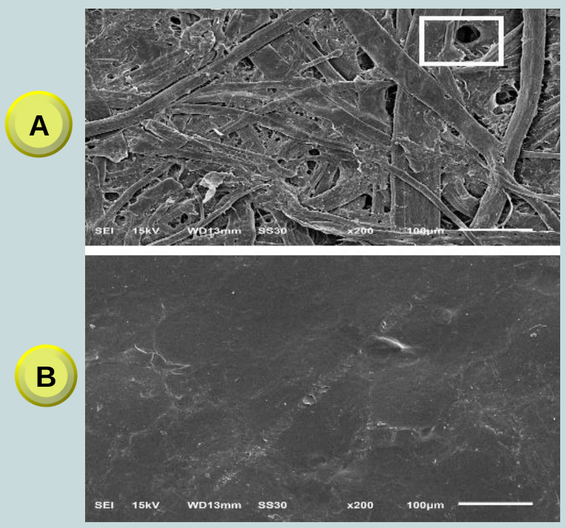


Figure3. SEM images (200×) of **A)** uncoated kraft paper and (**B**) Coated paper.

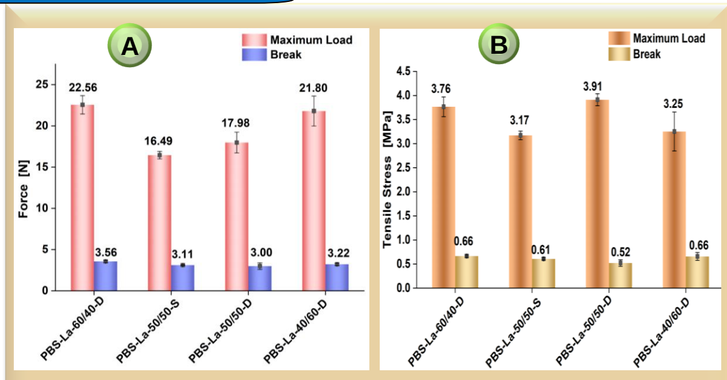


Figure 4. Force (**A**) and tensile stress (**B**) at maximum load and break of thermally sealed coated paper samples

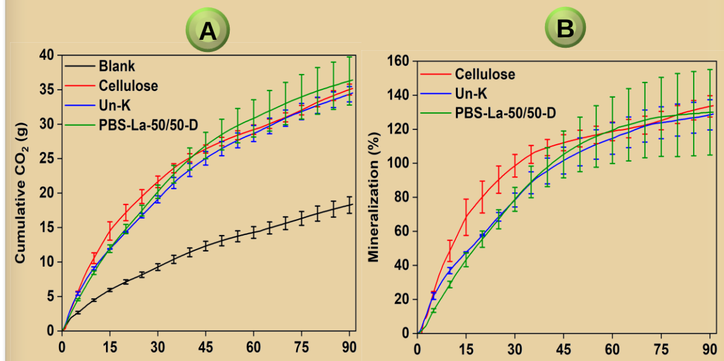


Figure 5. A). Cumulative CO_2 evolution and **B**) mineralization of blank, unmodified kraft paper, cellulose and coated paper substrate.

PBS latex was successfully prepared by a dissolution-evaporation method using a blend of HMW and LMW PVOH. The PBS-latex coated paper showed good water and oil resistance as well as excellent thermal sealing and biodegradability.

Acknowledgement

This study was developed under Assistance Agreement No. SU840402 awarded by the U.S. Environmental Protection Agency.

References

I. Bayer, I. S., et al., *Macromolecules.* 2014, 47, 5135−5143.
II. Khwaldia, K., et al., *Food Sci. Technol*. 2004, 39, 403−411.
III. Zhang, X., et al., *Appl. Surf. Sci*. 2017, 396, 1580−1588.