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CASSAVA STARCH/ CARBOXYMETHYLCELLULOSE BIOCOMPOSITE FILM FOR FOOD PAPER PACKAGING WITH TURMERIC OIL AS ANTIFUNGAL AGENT

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ABSTRACT

Paper and paperboard are commonly laminated with polyethylene (PE) to enhance its functionality but defeated it purpose as recyclable material. In an effort to encounter the issue, biopolymer composite film from cassava starch and carboxymethylcellulose (CMC) was studied as alternative of PE as film coating material. In this study, glycerol and turmeric oil was added in the biopolymer film as plasticizer and antifungal agent, respectively. Firstly, 5% w/w cassava starch was gelatinized at temperature 75°C and glycerol was added at different values (15% and 30% v/w starch). Meanwhile, CMC was dissolved in 100 mL distilled water at different weight percentage which are 5, 10, 20, 30, 40 and 50% w/w starch. The solutions were then mixed and viscosity was measured. Turmeric oil was then added in solution mixtures at different volume (5, 10, 15, 20, 25 and 30 μL). Casting method was used to apply film-forming solution on kraft paper. Drying of solution takes place at 60°C for two and half hours and characterization studies was conducted. Tensile strength, strain to break and wettability measurements indicated that the biopolymer film containing 30% (v/v starch) glycerol and 10% (w/w) CMC labelled as BF 5 had the highest tensile strength (15 MPa) but had the lowest value of strain to break, and exhibit hydrophobic properties. Meanwhile, addition of turmeric oil into developed BF 5 showed insignificant changes in tensile strength and percentage of strain to break but exhibit hydrophilic properties except for film with 15 μL turmeric oil. A comparison study of BF 5 with commercially (PE-coated) used in food packaging showed that BF 5 exhibit almost similar hydrophobic properties but had higher tensile strength than the commercial. Besides, thermogravimetric analysis identified that BF 5 had less residue than PE-coated and this indicated that BF 5 film degraded faster. Response surface methodology (RSM) was employed to study the effect of coating thickness and antifungal agent volume on the functional properties and biodegradability of BF 5. The functional properties of the BF 5 were determined through the release of antifungal agent and antifungal activity meanwhile biodegradation study was conducted in typical condition of home composting system. The results of the study showed that both of the coating thickness and turmeric oil volume significantly affected all the responses. From the response surface plot, the highest value of inhibition zone of *Aspergillus niger* occurred at the lowest percentage of antifungal agent release. This indicates that released of antifungal agent sources occurred at right stipulated period of time required for growth of the *A. niger*. The weight loss percentage of the biopolymer film after degradation process decreased with increasing coating thickness and the lowest value were identified at the same point of the lowest percentage of antifungal agent release. Therefore, the results suggested that applying the biopolymer film containing turmeric oil as kraft paper coating may improve its functionality in prolongs the shelf life of foods. Besides, all the samples able to degrade in typical conditions of soil which showed that it can be disposed in landfills after been used. Thus, it can be stated that the develop biofilm could replace the currently used petroleum based derivative plastic in the food industry.

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NURUL FATIN ALIA BINTI MUSTAPHA, 2019

TABLE OF CONTENTS