# Development of Environmentally Friendly Cellulose Containing Packaging Products From Waste Materials

A.M.P.B Samarasekara[1], P. Somasuntharam[2] and S. Umadaran[3]

Polymers are highly multipurpose class of materials which are found in all areas of engineering from daily products to biomedical devices. Polymers are increasingly being used as a substitute for conventional material systems. The applications of polymeric materials and their composites are still growing rapidly due to different properties. They are inexpensive, durable and versatile and used for an endless variety of applications. However, polymers have a significant environmental impact after usage. Total management of polymer waste needs complementary combinations of incineration, recycling and biodegradation. Biodegradation is the environmentally friendly waste management method. Biodegradable plastics undergo degradation from the action of naturally occurring microorganisms such as bacteria, fungi and algae. The aim of this research is to develop biodegradable polymer composite materials using cellulose and Low Density Polyethylene. Cellulose is the most structural component in herbal cells and tissues. Cellulose is a natural long chain polymer that plays an important role in human food cycle indirectly. This polymer has versatile uses in many industries such as veterinary foods, wood and paper, fibers and clothes, cosmetic and pharmaceutical. Sugarcane bagasse is abundantly available agricultural waste world-wide which is being used in different applications due to its relatively high availability of cellulose. Approximately 41% of cellulose was extracted during this research from sugarcane bagasse. Laboratory type mixing equipment was used to mix LDPE and cellulose. Mixing parameters were $130^0$C mixing temperature with 10 minutes mixing time. Different types of compositions were prepared by changing cellulose concentration. Hydraulic press was used to prepare the samples to evaluate their biodegradability. Soil burial test was performed to analyze the degradability of the developed product for 12 weeks. Tensile strength, elongation at break, water absorption and weight loss were performed before and after the soil burial test. All samples containing cellulose showed a significant weight loss compared to pure LDPE during the soil burial test. Weight loss increased with increase of in cellulose concentration and maximum weight loss was observed in 6 %w/w. cellulose containing sample. Maximum weight loss was 3.4% after 12 weeks. Pure LDPE didn't show any water absorption but all samples containing cellulose displayed the water absorption qualities during the soil burial test. Cellulose 6%w/w. sample showed 45% tensile strength reduction after the 12 weeks during soil burial test. Tensile strength of all cellulose containing samples showed a significant reduction with increase in cellulose concentration during the soil burial testing period. Property of elongation at break also showed same type of degradation pattern for developed product during the testing period. According to all these data obtained it clearly showed the degradation of the cellulose – LDPE based product during the 12 weeks. This cellulose containing degradable product can be used as an environment friendly packaging material to create a clean environment.

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1 Department of Materials Science and Engineering, University of Moratuwa, Sri Lanka. banduamp@yahoo.com

2 Department of Materials Science and Engineering, University of Moratuwa, Sri Lanka, smpriya1016p@gmail.com

3Department of Materials Science and Engineering, University of Moratuwa, Sri Lanka, umadaran@gmail.com