CUSTOMIZABLE TOOLS FOR MEASURING POLYMER DEGRADATION

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Man-made plastics and natural biomass are a rich source of carbon-based chemicals. There is growing interest in developing more efficient methods for converting these polymeric materials into value-added chemicals. A challenge in working with polymers is they are insoluble in aqueous solutions. Consequently, they interfere with direct photo- and fluorometric measurements. To eliminate this problem, we have devised 3D printed biomass containment devices that simplify the measurement of polymer degradation in real-time. A related devise is a centrifuge filter. We have designed a reusable filter device that fits into standard sized centrifuge tubes and can be used with a filter of any pore size. The utility of the device was demonstrated using a dye release assay.

The assay used Azocoll, an insoluble protease substrate to which a dye is covalently attached. Proteolytic degradation results in the release of soluble dye. The Azocoll in buffered saline was placed into the top portion of the centrifuge devices fitted with 0.2 μm filters. A protease solution was dispensed into the filter devices at staggered time intervals and incubated. The devices were centrifuged to separate the released dye from the substrate. The absorbance at 520 nm of the filtrate solution was measured. The results showed a time-dependent increase in absorbance in the filtrate, which was indicative of the Azocoll substrate being degraded by the protease. It is predicted that by changing the pore size of the filter, polymer fragments of different sizes can be obtained thereby permitting more precise analyses of polymer degradation.

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