

Degradation of PBAT/PBS Polymer Blends and Cellulose Biocomposites in Abiotic Marine Simulating Solutions

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Global plastic production has grown rapidly over the past two decades and reaching 400 million tons in 2023, of which 8.4% comes from recycled plastic and 0.7% from bio-based. Due to poor management, 10 to 20 million tons of plastic enter the ocean every year, and the amount of plastic may exceed fish stocks by 2050. Plastic waste is a source of secondary microplastics and nanoplastics, as larger fragments break down and fragment through a combination of photochemical, biological, mechanical and chemical degradation depending on environmental conditions. Biodegradable plastics made from renewable or fossil resources, such as polylactic acid (PLA), polyhydroxyalkanoates (PHA), poly(ϵ -caprolactone) (PCL), polybutylene succinate (PBS) and polybutylene succinate-co-adipate (PBSA), are seen as alternatives to non-degradable plastics. However, some of these polymers have been found as microplastics in the marine environment. For example, PCL fragments have been found in the Mediterranean Sea, suggesting that biodegradable plastics may not be easily degradable under natural conditions and therefore cannot completely solve the problem of marine pollution. The long-term use of biodegradable plastics may lead to similar problems as conventional plastics due to improper handling and accumulation in the environment. In this context, more research is needed to evaluate the degradation of biodegradable plastics under simulated marine environmental conditions to determine whether they represent a sustainable solution to address marine pollution or whether they can accumulate in marine ecosystems under current and future environmental conditions. In this study, blends of polybutylene adipate terephthalate (PBAT), PBS, and cellulose were prepared to evaluate their degradation behavior under simulated marine environmental conditions. Degradation in abiotic solutions at different temperatures and pH values was studied to simulate the effects of climate change and ocean acidification. Three different environmental conditions were tested to see how these factors affect the degradation of these bioplastics. The aim was to understand the impact of these changes on the degradation rate of plastics, especially in the context of increasing climate change and ocean acidification.