

AC-COOL, the Key to a New Green Process for Making Biodegradable Bioplastic from Agricultural By-products

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A “green process” including two main stages (i) hydrolysis of agricultural by-products (ABP) into fermentable sugar (ii) fermentation of sugar into bioplastics, was established to use ABP resources to produce polyhydroxyalkanoates (PHA). A novel bi-functional catalyst called AC-COOL for that process was invented is made from activated carbon. Furthermore, AC-COOL is very easy to synthesize by treating activated carbon with H₂O₂ causing no pollution to the environment and the COOH group is more than fivefold compared to parent AC. AC-COOL is also inexpensive, about 140 times cheaper compared to enzymes. By utilizing AC-COOL, the obtained hydrolysate from the stage (i) can be directly fermented to produce bioplastic without any detoxification involvement. AC-COOL catalyst creates viable living conditions for the micro-organisms in the final stage which results as efficient as using enzyme in the conventional process. The conversion of cassava peel, corncob, and canna bulbs is approximate 86%, 47.5%, 47% respectively. The yield of sugar into PHA is close to 20%. Interesting enough, AC-COOL can easily be regenerated and reused up to four times while maintaining its high catalytic performance. The latest treatment of activated carbon with O₃ resulted in AC-COOL with high activity. The catalyst can be reused 7 times. AC-COOL possesses a bi-functional characteristics simultaneously acting as a catalyst and an adsorbent. Therefore, the application of AC-COOL have been utilized to develop not only a novel but also a simple hydrolysis route for lignocellulose. As a result, the complete process to transform agricultural by-products into PHA is efficiently green. Its proven ease of processing and efficiency make this green process a great potential of being commercialized.