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) hydrolysation of agricultural by-products (ABP) into fermentable sugar (ii) fermentation of sugar into bioplastics, was established to use ABP resources to produce polyhydroxylalkanoates (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, cornbob, 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.

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