Hybrid vs. Alkali: Finding a More Sustainable Method to Produce Chitosan-Based Superabsorbent Polymers From Agaricus bisporus Fungi

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Synthetically created superabsorbent polymers (SAPs) are used in everyday items like diapers, bandages, and feminine hygiene products. These SAPs are not biodegradable, and the production process is very harmful to the environment, making them a pressing issue for the world today. Chitosan, a natural polysaccharide derived from chitin, is a promising alternative; however, the process of making chitosan-based SAPs is also environmentally harmful. As a potential solution, I created a hybrid production method to minimize the amount of harmful chemicals used in order to create a more sustainable process. I hypothesized that if I use both fermentation and alkaline chemicals to produce chitosan-based SAPs from fungi, then it will be a more sustainable process with similar results to the pure alkali method. To test this, I fermented Agaricus bisporus with Lactobacillus acidophilus to break down the carbohydrates and proteins in the fungal cells. I then continued by using a series of low-molarity NaOH and H_2SO_4 solutions to cause the partial deacetylation of chitin into chitosan. Finally, I compared the Chitosan-based SAPs with synthetic SAPs and found that my Chitosan-based SAPs performed almost as well as the synthetic SAPs while exceeding the industrial standard for percent absorbency. This means that my hybrid process was effective at creating SAPs from fungi and could be a sustainable production method. This is very promising for the future as, with some refinement, my hybrid process can be used worldwide to cut down on plastic waste and help create sustainable production of superabsorbent polymers.

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