435n Production of Polyhydroxyalkanoates from Cellulosic Feedstocks Using Ralstonia Eutropha

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The research aims to produce short chain length polyhydroxyalkanoates (scl-PHA) from cellulosic feedstocks. PHAs are biodegradable polymers similar to plastics in physical properties, but they have comparatively higher production costs. PHAs could effectively replace non-biodegradable polymers if production costs could be reduced. One objective of this project is to grow the PHA producing organism, Ralstonia eutropha in a low-cost, condensed corn solubles (CCS) medium to create a highly concentrated cell mass (CCM). We monitored the rate of growth and maximum cell mass of the organism in different concentrations of CCS media compared to control media (i,e nutrient broth and a defined medium). No growth was seen in the 400g/l CCS medium. The organism grew at slower rate in the 80g/l CCS medium. However, the growth rates in the control media and the 240g/l CCS medium were comparable. So we considered 240 g/l CCS to be the best medium for growing the organism. To maximize cell growth, we will supplement the CCS media with nitrogen. We will evaluate the effectiveness of three different carbon to nitrogen ratios, 4:1, 8:1 and 20:1in promoting the growth of the organism. The level of nitrogen at which maximum CCM produced will be considered as the optimum media for growing Ralstonia eutropha. Our second objective will be to identify nutrient limiting conditions to initiate PHA production by the CCM. Then volatile fatty acids, derived from anaerobic digestion of cellulose (part of a secondary project) will be fed to R. eutropha for production of scl PHA. We will add the acids individually at first to determine tolerance levels and then will investigate addition of multiple acids to optimize production of PHA. Cell mass will be determined by centrifugation, whereas PHA will be extracted from the intracellular granules by Supercritical Fluid Extraction (SFE). The properties and the composition of the scl PHA will be determined, as well as information on cost, productivity and yield of this bio-based product. Moreover the byproducts of this process will be tested for their nutritional value in livestock rations.