PRODUCTION OF VOLATILE FATTY ACIDS USING WHOLE STILLAGE

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ABSTRACT

The objective of this study is to convert whole stillage (a byproduct of corn ethanol production), into a mixture of volatile fatty acids (VFAs). These VFAs will subsequently be converted to polyhydroxyalkanoate via *Ralstonia eutropha*. We have acclimated a mixed rumen culture to produce more VFAs and less gas when grown on whole stillage. Acclimation was carried out by repeatedly subculturing the rumen consortium on whole stillage that contained low levels of ionophores (Rumensin, Bovatec, and Cattylst) which repressed gas producing microbes. After several such transfers, the rumen culture maintained low production of gas even when the ionophores were no longer added. Unfortunately, this acclimation also resulted in the reduction or loss of cellulase producing microbes, which can also be inhibited by ionophores. To increase cellulose digestion and VFA production, we will evaluate various pretreatments and/or addition of commercial cellulase enzymes or microbes that produce cellulase. Initial trials evaluated a group of six commercial hydrolytic enzymes, obtained from Novozyme, at recommended and 10X recommended rates. Saccharification trials were conducted at 50°C Celsius for 72 hours, with routine HPLC analysis. Results indicated that the enzyme, NS50012, at the recommended rate was the best for increasing VFA production based on sugar concentration after 72 hours. Subsequent trials will evaluate combinations of the best enzymes at the recommended rate. Pretreatments to be evaluated will include hot cook and near critical water treatments, in which temperature is the primary variable. We also plan to explore the feasibility of re-introducing cellulase producers into the acclimated rumen consortium.