Bioethanol production by inherent enzymes from rye and wheat with addition of organic farming cheese whey

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In organic farming, there is a strong effort to minimize the share of non-renewable resources (e.g. fossil fuels) and use only (preferably on-farm produced) bio-based energy and renewable raw materials, with the aim of achieving sustainable production systems and to become self-sufficient in energy. Throughout our studies, wheat and rye grain was used as raw material in bioethanol production with the purpose of producing in situ enzymes (during germination) for the hydrolysis of starch in the grains and compared with commercial amylase enzyme preparations. Whey permeate was incorporated into the grain in Simultaneous Saccharification and Fermentation (SSF) process to use a cheap nutrient and water source. The ethanol fermentations were completed by 190 h. The fermentation efficiency of germinated and un-germinated grains (without commercial enzymes) was compared with that of commercial enzymes in SSF and furthermore Autoamylolytical Quotient (AAQ) was calculated. On rye 72% yield of the theoretical was achieved by applying commercial enzymes, which decreased only by 10%, when in situ enzymes produced during germination were used alone. The obtained ethanol yields and high (90%) AAQ values showed that rye is a suitable substrate for autoamylolytical processes. According to the low yields (}

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