FERMENTATION OF RESIDUAL BIOMASS IN THE PRESENCE OF DIHYDROXYFUMARIC ACID

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Abstract. Liquid wastes generated by the wine-production may pose essential environmental and health risks while improperly handled. Biochemical anaerobic processes are considered particularly advantageous treatment methods of such wastes from the economic and environmental perspectives. Our studies had shown that introduction of bioactive additives into the fermentation process can improve the biomass digestion accelerating biogas production and increasing the biomethane yield. One of the most active additives, dixydroxyfumaric acid (DHFA), was used in the computational studies that allowed to elucidate the accelerating effect of this bioadditive on anaerobic fermentation of waste biomass. DFT calculations revealed that, in the multi-stage anaerobic digestion, the promoting effect of DHFA occurs during the enzymatic phosphorylation reaction in the presence of Mg^{2+}-ATP complexes. The proposed molecular mechanism provides a possible explanation for the experimentally observed enhancement of anaerobic biomass fermentation in the presence of DHFA.

Keywords: biochemical process, anaerobic fermentation, bioactive substance, reaction mechanism, DFT calculations.