Mechanical pretreatment is considered to be a fast and easily applicable method to prepare the biomass for anaerobic digestion. In the present study, the effect of mechanical pretreatment on lignocellulosic silages biodegradability was elucidated in batch reactors. Moreover, co-digestion of the silages with pig manure in continuously fed biogas reactors was examined. Metagenomic analysis for determining the microbial communities in the pig manure digestion system was performed by analysing unassembled shotgun genomic sequences. A comparative analysis allowed to identify the microbial species firmly attached to the digested grass particles and to distinguish them from the planktonic microbes floating in the liquid medium. It was shown that the methane yield of ensiled grass was significantly increased by 12.3% due to mechanical pretreatment in batch experiments. Similarly, the increment of the methane yield in the co-digestion system reached 6.4%. Regarding the metagenomic study, species similar to Coprothermobacter proteolyticus and to Clostridium thermocellum, known for high proteolytic and cellulolytic activity respectively, were found firmly attached to the solid fraction of digested feedstock. Results from liquid samples revealed clear differences in microbial community composition, mainly dominated by Proteobacteria. The archaeal community was found in higher relative abundance in the liquid fraction of co-digestion experiment compared to the solid fraction. Finally, an unclassified Alkaliphilus sp. was found in high relative abundance in all samples.