Effect of prompt-delayed packaging and ensiling time on fermentation and aerobic stability of soybean curd residue

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Background and Objective

Production of tofu and soymilk generates considerable amounts of soybean curd residue (SCR) during the manufacturing process. About 0.7 million tons of SCR is disposed in Japan annually, but some of them are yet incinerated and landfilled, which costs around 16 billion yen per annum for disposal. Soybean curd residue (SCR) would spoil soon after production especially in summer. Ensiling is a most convenient way to preserve SCR, but quick packaging is not necessarily secured in practice.

Objectives: To examine how prompt and delayed packaging can influence on fermentation and aerobic stability of SCR silage in different ensiling time and also to identify the microbial dynamics in SCR silage comprehensively.

Materials and Methods

Two sets of SCR were obtained from two tofu factories, and then each was further divided into two subsets. The first subset of SCR was ensiled soon after production (prompt packaging), and the second subset was ensiled two days after production (delayed packaging). Laboratory silos were prepared in triplicate. Silages were opened after 2 weeks and 3 and 6 months to examine fermentation products and aerobic stability. Bacterial and fungal microbiota were assessed using 16S and 18S rRNA genes amplicon sequencing.

Results and Conclusion

Although good fermentation occurred in both delayed and prompt packeted silages, the lactic acid content was higher in delayed packed silage. After aerobic exposure, spoilage was observed earlier in promptly packed silages, and the aerobic stability was negatively affected by storage time. Looking at bacterial community profile, the relative abundances of Lactobacillaceae and Streptococaceae were higher in prompt packaged silage. Othe other hand the relative abundance of Bacillaceae was higher with delayed packed silages regardless of the storage periods. According to prolonged ensiling, the lactic acid content was decreased and the butyric acid content was increased. Surprisingly we detected Clostridiaceae only with prompt packaged silage stored for 6 months. Looking at fungi community profile; the relative abundance of Saccharomycetaceae (mainly Candida spp.) was higher in long-stored silage, whereas Trichocomaceae (mainly Aspergillus spp.) was decreased along with the storage time. Distinctly factory-to-factory difference was found for ensiling fermentation and the associated microbiota of SCR silage.

[Conclusion] The quality and aerobic stability of SCR silage can be decreased in long time storage. In lab scale silo delayed packaging SCR silage was well preserved, there might be other bacteria also involved in delayed packed silage fermentation. We need further investigation to understand the specific bacteria and substances which improve such fermentation and aerobic stability in SCR silage. According to bacterial dynamic profile there is greater difference exist between SCR and forage crop silages.