# Study on Nutrient Composition and Fermentation Quality of *Caragana korshinskii* Kom. Anaerobic Fermentation with Different Additives under Low Moisture Conditions

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**ABSTRACT**
The purpose of this experiment is to explore the effects of different additives on the anaerobic fermentation of *Caragana korshinskii* Kom. with low moisture. The research of adding additives to the anaerobic fermentation test of *C. korshinskii* Kom results show that, adding cellulase alone significantly increased the content of hemicellulose, but the content of soluble carbohydrates was significantly reduced ($P<0.05$). The lactic acid production was increased in the treatment group added with lactic acid bacteria, but there was no significant difference ($P<0.05$). The treatment of different additives had significant effects on *C. korshinskii* which under an anaerobic fermentation, but the mechanism is still not clearly. The effect of adding both lactic acid bacteria and cellulase led to a wonderful result of *C. korshinskii.* In order to explore the mechanism, different moisture content and different additive dosages should also be investigated.

***Keywords:*** *Caragana korshinskii* Kom, Additives,Anaerobic Fermentation.

## 1. INTRODUCTION

*Caragana korshinskii* Kom. is a very resource-rich unconventional feed, distributed in Northwest, North and Northeast China. It has been mainly used for windbreak and sand fixation and soil and water conservation. But, utilization in animal husbandry was only limited to the young twigs, so the utilization rate is extremely low, resulting in obvious feed waste. *C. korshinskii* has anti-drought, cold resistance, barren tolerance, high biomass, vigorous growth, windproof and sand fixation, etc. It has become an important greening and water and soil conservation in the loess hilly area. Afforestation shrub species. At the same time, because of its lush foliage, rich in camp Nourish materials, and become an important source of nutrition for herbivorous livestock. The scientific and reasonable development and utilization of *C. korshinskii*. forage resources has important and long-term significance for alleviating the shortage of feed resources, promoting the healthy development of animal husbandry, and realizing the organic combination of economic, social and ecological benefits of *C. korshinskii.* [1]. The purpose of this experiment was to study the sealed fermentation of *C. korshinskii.* by adding lactic acid bacteria and cellulase under low moisture conditions, analyze the changes in various nutrients and fermentation indicators in the feed, and give reasonable suggestions in production.

## 2. MATERIALS AND METHOD

### *2.1. Materials*

The materials *Caragana korshinskii Kom.* were provided by Inner Mongolia Jinji Biological Technology Co., Ltd. (Forestry Industrial Park, Daban Town, Balinyou Banner, Chifeng City, Inner Mongolia Autonomous Region) on October 10, 2020. The *C. korshinskii.* is in the pod stage. The present study also used *Lactobacillus plantarum* CAU-214 (LAB; The dosage of lactic acid bacteria is $1 \times 10^{11}$ cfu $g^{-1}$) and Cellulase (CE; Enzyme activity $\geq$ 15000U $g^{-1}$).

### *2.1. Method*

Materials were chopped with lengths of 2 to 4 cm by a hand forage chopper and mixed well. The dosage of lactic acid bacteria added is $1 \times 10^{6}$ cfu $g^{-1}$ FM in LAB group. The dosage of cellulase added is 40 mg $kg^{-1}$ in CE group. Add $1 \times 10^{6}$ cfu $g^{-1}$ FM CAU-214 and 40 mg $kg^{-1}$

 

cellulase in LAB+CE group. Add distilled water for CK group. Total of 500g from each sample was sealed and fermented. Each treatment was in three replications. Sample analysis after 90 days consisting of pH, $NH_3$-N, and organic acids were determined according to the methods [2]. Each sample were dried in an oven at 65℃ for 48 h, and ground to pass through 40-mesh sieve. Dry matter (DM), neutral detergent fiber (NDF), acid detergent fiber (ADF), water soluble carbohydrate (WSC), crude fat (EE, ether extract), CP (crude protein), were determined according to the previous methods [3,4].

All data obtained in the present study were analyzed using One-Way Analysis of Variance (ANOVA) to determine different inoculants treatments, and Duncan's multiple range test was conducted to post hoc analyses via SPSS 26.0 software. Statistical significant difference was set at $P < 0.05$.

## 3. RESULTS AND DISCUSSION

The nutrient composition was shown in Table 1. The treatment of different additives has a significant influence on HC, WSC, EE. Adding lactic acid bacteria reduced the dry matter content of *C. korshinskii*. Compared with the control group and the lactic acid bacteria group alone, the cellulase added alone had a significant increase in hemicellulose content, which showed that cellulase also has a certain effect under low-moisture feed conditions.

**Table 1.** Effect of additives on nutrient composition of *C. korshinskii*.

| Items (DM %) | Different additives treatment | | | | SEM | *P*-vale |
|---|---|---|---|---|---|---|
| | CK | LAB | CE | LAB+CE | | |
| DM | 77.97$^{a}$ | 75.49$^{b}$ | 77.46$^{ab}$ | 76.52$^{ab}$ | 0.972 | 0.131 |
| CP | 8.20 | 8.68 | 8.15 | 7.83 | 0.566 | 0.543 |
| NDF | 74.09 | 73.42 | 75.36 | 74.08 | 1.787 | 0.750 |
| ADF | 54.99 | 54.73 | 54.35 | 54.35 | 1.882 | 0.981 |
| HC | 19.10$^{b}$ | 18.70$^{b}$ | 21.01$^{a}$ | 19.73$^{ab}$ | 0.690 | 0.045 |
| WSC | 2.20$^{a}$ | 2.06$^{a}$ | 1.49$^{b}$ | 1.89$^{ab}$ | 0.190 | 0.027 |
| EE | 1.93$^{b}$ | 2.40$^{a}$ | 1.89$^{b}$ | 2.19$^{ab}$ | 0.126 | 0.011 |

Description: DM, dry matter; CP, crude protein; NDF, neutral detergent fiber; ADF, acid detergent fiber; HC, hemicellulose. WSC, water soluble carbohydrates; EE, crude fat (ether extract); SEM, standard error of means; Means (n = 3) with different letters in the same row (a-b) are significant at $P < 0.05$.

Compared with the control group and the lactic acid bacteria group alone, cellulase added alone showed a significant increase in hemicellulose content, which indicated that cellulase had a certain effect on the conversion and utilization of *C. korshinskii*. under low-moisture conditions. However, the content of water-soluble carbohydrates was significantly reduced, but the content of lactic acid did not increase was shown in Table 2, which might be consumed by other microorganisms. Table 2 showed that the lactic acid production was increased with LAB inoculated, but there was no significant difference between LAB and LAB+CE. It was possible that the substrate decomposed by cellulase was not effectively used by lactic acid bacteria.

**Table 2.** Effect of different additives on fermentation parameters of *C. korshinskii*.

| Items (DM %) | Different additives treatment | | | | SEM | *P*-vale |
|---|---|---|---|---|---|---|
| | CK | LAB | CE | LAB+CE | | |
| pH | 4.59$^{a}$ | 4.43$^{b}$ | 4.45$^{b}$ | 4.27$^{c}$ | 0.059 | 0.005 |
| LA | 3.91$^{b}$ | 9.73$^{a}$ | 5.82$^{b}$ | 8.18$^{a}$ | 0.940 | 0.001 |
| AA | 2.11$^{b}$ | 5.14$^{a}$ | 3.68$^{ab}$ | 3.50$^{ab}$ | 0.823 | 0.039 |
| PA | 0.82 | 0.68 | 0.97 | 0.81 | 0.404 | 0.912 |
| $NH_3$-N | 0.54$^{a}$ | 0.73$^{b}$ | 0.39$^{c}$ | 0.41$^{c}$ | 0.038 | 0.000 |

Description: LA, lactic acid; AA, acetic acid: PA, butyric acid; NH3-N , Ammonia nitrogen; SEM, standard error of means; Means (n = 3) with different letters in the same row (a-b) are significant at $P < 0.05$.

## 4. CONCLUSIONS

The treatment of different additives had significant effects on *C. korshinskii*, which under an anaerobic fermentation, but the mechanism was still not clearly. The effect of adding both lactic acid bacteria and cellulase led to a wonderful result of *C. korshinskii*. In order to explore the mechanism, different moisture content and different additive dosages should also be investigated.

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