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不同汽爆预处理对干玉米秸秆青贮效果的影响

Effect of steam explosion pretreatment on ensiling performance of dry corn stover

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中文摘要:

为了扩大可用于青贮的玉米秸秆资源量，通过借鉴青贮、黄贮和汽爆玉米秸秆加工技术的优点，该文提出使用低强度汽爆对干黄玉米秸秆进行预处理，改进玉米秸秆贮效果的方法。通过低强度汽爆（0.6～1.4 MPa，5 min）将玉米秸秆中的半纤维素适当降解为寡糖和单糖，增加玉米秸秆中的可溶性糖含量。调节质量含水率为70%，使用塑料袋密闭汽爆预处理后的玉米秸秆进行青贮。通过检测青贮过程中pH值、有机酸含量、氨态氮占总氮的比例等参数，并使用农业部青贮饲料质量评定标准对获得青贮饲料进行评分。结果显示低强度汽爆（1.0 MPa，5 min）预处理可有效的增加干黄玉米秸秆中的可溶性糖含量，使饲料等级从"一般"到"优"。该方法可有效地增加可于青贮的玉米秸秆资源量。

英文摘要:

Abstract: Ensiling is an important crop straw feed processing method. It can not only effectively improve the nutritional value of crop straws, but also increase the storage time Currently the corn and silage corn cultivated areas are 3.35×107 and 2.083×106 hm2 in China. The corn stover (CS) annual production is about 260 million tons. However, due to requirements of the moisture content and freshness, only the un-harvested or newly harvested CS can be used as ensiling. This limits the operation time of ensiling and the scope CS. In order to expand the available range of CS and reduce the unnecessary use of additives, the advantages of three straw feed processing methods of silage, microbial silage ar steam explosion were studied. On these bases, the feasibility of improving dry CS ensiling performance by steam-explosion pretreatment was tested in this work.First, the dry CS w cut into 3-5 cm, adjusted the moisture content to 50% (w/w) and pretreated under different intensities (0.8-1.4 MPa, 5 min) in a 5 L steam explosion reactor. The steam-exploded CS water-washed to remove the soluble fraction. Then the structural components of cellulose, hemicellulose and Klason lignin in the solid residual and the soluble sugar, acetic acid furfural in the water-washed liquor were determined according to the two-step quantitative hydrolysis method recommended by National Renewable Energy Laboratory (NREL). B on these data, the material recovery ratio was calculated to evaluate the efficiency of steam explosion pretreatment.Then, the pretreated and un-pretreated CS samples were used i ensiling experiments. In addition to water, any microbial inoculants and enzyme was not used. The samples including control samples were added tap water according to the real moisture content and adjusted the final moisture content to 70% (w/w). Each 5 kg sample was loaded in a sealed plastic bag and ensilaged in 15-25℃. Throughout the experiment, silage feed pH value, organic acids and volatile basic nitrogen (VBN)/total nitrogen were determined from the periodic sampling (5, 15, 30 and 60 d). After six months ensiling, the silages were scored according to the Silage Quality Assessment Criteria issued by the Chinese Ministry of Agriculture.The results showed that the steam explosion pretreatment degrade the hemicellulose in CS and increase the oligosaccharides and monosaccharides content in CS. According to the pretreatment intensity, the soluble sugars content in the increased from 17.51% to 19.58%-25.77%. At the same time, the pH value of raw materials decreased from 7.09 to 6.14-4.26. The saccharide produced during the pretreatment playe positive role to lactic acid bacteria growth in the ensiling. The silage pH value, the proportion of VBN/total nitrogen decreased significantly, and the feed quality was improved. T pretreated CS from the optimum conditions (1.0 MPa and 5 min) increased its final score from 50 (normal) to 83 (excellent). The results also showed that higher pretreatment intensi could not only increase the soluble sugar content, but also the furfural content in the pretreated CS. When the pretreated steam pressure was higher than 1.0 MPa, the furfural production increased significantly. Furfural made the pretreated CS smelled pungent, also affected the microorganisms growth. So, for the final quality of silage, the suitable steam explosion pretreatment intensity choice was very important.Low intensity steam explosion pretreatment made the dry CS obtaining a good ensiling performance, and which expand the ensiling substrates range.

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