



动物营养学报

CHINESE JOURNAL OF ANIMAL NUTRITION

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动物营养学报 2013, Vol. 25 Issue (10) :2303-2314 DOI: 10.3969/j.issn.1006-267x.2013.10.014

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利用双外流持续发酵系统研究植物精油对瘤胃发酵和甲烷生成的影响

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Effects of Plant Essential Oil on Rumen Fermentation and Methanogenesis Studied Using a Dual Flow Continuous Culture System

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摘要 本研究采用双外流持续培养法, 探讨添加不同水平的植物精油对瘤胃发酵和甲烷(CH₄)生成的影响。每种植物精油(肉桂油和留兰香油)的4种添加水平(0、100、500和1 500 mg/L)作为处理因素, 每个处理3个重复, 每个试验周期为6 d。结果表明: 与对照组相比, 1) 添加1 500 mg/L的肉桂油显著降低了发酵液pH、饲料中性洗涤纤维降解率(dNDF)、酸性洗涤纤维降解率(dADF)和粗蛋白质降解率(dCP)(P<0.05)。2) 添加100 mg/L的留兰香油和肉桂油对挥发性脂肪酸(VFA)浓度和乙酸/丙酸(A/P)无显著影响(P>0.05)。添加500 mg/L的肉桂油在发酵27和99 h以及添加1 500 mg/L的肉桂油在所有发酵时间点均显著降低了总挥发性脂肪酸(TVFA)、乙酸和丙酸浓度(P<0.05)。随着发酵时间的延长, 1 500 mg/L肉桂油添加组TVFA、乙酸和丙酸浓度显著下降(P<0.05), A/P显著升高(P<0.05)。3) 添加500 mg/L的肉桂油以及1 500 mg/L的肉桂油和留兰香油均显著降低了发酵液中的原虫数量(P<0.05)。添加3种剂量的肉桂油和留兰香油均显著降低了CH₄体积分数(P<0.05)。由此可见, 添加100 mg/L的肉桂油和留兰香油均有助于改善瘤胃微生物发酵。

关键词: 植物精油 连续培养 瘤胃体外发酵 CH₄

Abstract: This experiment was conducted to study the effects of essential oil supplemental level on rumen fermentation and methanogenesis using a dual flow continuous culture system. The four supplemental levels (0, 100, 500 and 1 500 mg/L) of cinnamon oil or spearmint oil were used as the treatment factors, there were 3 replicates per treatment and each experiment lasted for 6 days. The results showed as follows: compared with the control group, 1) the supplementation of 1 500 mg/L cinnamon oil significantly decreased the pH, neutral detergent fibre degradation rate, acid detergent fiber degradation rate and crude protein degradation rate (P<0.05). 2) There were no significant differences in the concentration of volatile fatty acid and acetate/propionate ratios (A/P) in 100 mg/L cinnamon oil or spearmint oil groups (P>0.05). The concentrations of total volatile fatty acid (TVFA), acetate and propionate were significantly decreased in 500 mg/L cinnamon oil group at 27 and 99 h and 1 500 mg/L group at all the fermentation time (P<0.05). With the prolonging of fermentation time, the concentrations of TVFA, acetate and propionate were significantly decreased (P<0.05), and A/P was significantly increased in 1 500 mg/L cinnamon oil group (P<0.05). 3) The supplementation of 1 500 mg/L cinnamon oil or 500 mg/L spearmint oil significantly decreased the number of protozoa (P<0.05). The methane volume fraction in all groups was decreased compared with the control group (P<0.05). It is concluded that the supplementation of 100 mg/L cinnamon oil or spearmint oil may be beneficial to manipulate rumen microbial fermentation.

Keywords: essential oil, continuous culture, rumen fermentation *in vitro*, methane

收稿日期: 2013-04-19;

基金资助:

十二五科技支撑计划(2012BAD12B02); 中国科学院知识创新工程重要方向项目(XDA01010301)

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引用本文:

金恩望, 卜登攀, 王加启等. 利用双流持续发酵系统研究植物精油对瘤胃发酵和甲烷生成的影响[J]. 动物营养学报, 2013, V25(10): 2303-2314

JIN Enwang, BU Dengpan, WANG Jiaqi etc. Effects of Plant Essential Oil on Rumen Fermentation and Methanogenesis Studied Using a Dual Flow Continuous Culture System[J]. Chinese Journal of Animal Nutrition, 2013, V25(10): 2303-2314.

链接本文:

http://118.145.16.228/Jweb_dwyy/CN/10.3969/j.issn.1006-267x.2013.10.014 或

http://118.145.16.228/Jweb_dwyy/CN/Y2013/V25/I10/2303

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