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Development and characterization of a sustainable encapsulated methionine source

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The study was conducted to characterize a sustainable encapsulated methionine (enMET) source which has been recently developed via the replacement of a synthetic polymer (2-vinyl pyridine/styrene; VP) with a chitosan-based biopolymer (CH; KESSENT® Me, Kemin Animal Nutrition and Health, Belgium). In Exp 1, to evaluate the biodegradation of polymers, biological O2 demand (BOD) was measured for 20 days in a chamber, and theoretical O2 demand (ThOD) was estimated from chemical formula. Based on both values, biodegradation (BioDeg) were calculated. The BOD and ThOD (g O2/l) were 66.0 and 1.2 for CH; 2.4 and 20 for VP. BioDeg for the CH vs. VP was calculated as 56.7 vs. 0.1. In Exp 2, rumen batch cultures were used to evaluate the effects of ruminal incubation on the physical structure of both polymers. Duplicate samples were obtained at 0, 2, 4, 6, 8, 10, and 12 h. Microscopy analysis showed structural integrity alterations of VP polymers after 4 h compared with the CH by 12 h. Euclidean distance algorithm was used to judge polymer integrity on the whole FTIR spectrum, -COOH, and -NH2 groups. The VP showed greater spectral dissimilarity from the time-zero (1.0) compared to the CH (whole 0.75 vs. 0.91; -NH2 0.88 vs. 0.95; -COOH 0.55 vs. 0.91). In Exp 3, in vitro ruminal and intestinal degradability of CH samples (n = 145) were evaluated. The means of ruminal degradability (%) of DM and CP were 2.2 ± 0.2 and 3.8 ± 0.5; 5.1 ± 0.2 and 10.3 ± 0.5; 9.9 ± 0.3 and 17.4 ± 0.7; 20.7 ± 0.5 and 34.0 ± 1.0 after 4, 8, 12, and 24 h incubation, respectively. Total tract degradability (%) of DM and CP were 62.2 ± 0.5 and 91.0 ± 0.6 after 12 h rumen followed by 24h enzymatic treatment. In Exp 4, two ruminal/duodenal fistulated cows were used. In situ rumen CP degradation (%) of CH were 0 and 11.4 ± 5.2 after 8 and 16 h incubation, respectively. After 8h of rumen incubation, enzymatic treatment and intestinal incubation with mobile bags, CP of CH was completely digested after 9h:43m mean transit time. In conclusion, the biopolymer-based coating of enMET showed substantial biodegradation, while maintaining high ruminal stability and high intestinal availability.

KEYWORDS:
Methionine, degradability, sustainability