R-EF-10: Influence of Bedding Material on Ammonia Emissions from Cattle Excreta

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Abstract

Dairy cattle barns are a major source of NH₃ emissions to the atmosphere. Previous studies have shown that the bedding material used in the barn can influence the magnitude of NH₃ emissions, but little is known about which bedding characteristics are important in this respect. The aims of this study were to assess, at a laboratory scale, the relative importance of the chemical [pH, cation exchange capacity (CEC), C:N] and physical (urine absorbance capacity, bulk density) characteristics of 5 bedding materials (chopped wheat straw, sand, pine shavings, chopped newspaper, chopped corn stalks, and recycled manure solids) on NH₃ emissions from dairy cattle urine. Recycled manure solids were the most absorbent of the bedding types (4.2 g of urine/g of bedding), and sand was the least (0.3 g of urine/g of bedding). When beddings were soaked in urine to their absorbance capacities, NH₃ emissions over 48 h (expressed as a proportion of the urine N absorbed) were not significantly different among bedding types, despite differences in initial bedding pH, CEC, and C:N. When equal volumes of urine were applied to equal depths of dry bedding, NH₃ emissions over 48 h were significantly less from sand and pine shavings (23 and 42% of applied urine N, respectively) than from chopped newspaper, chopped corn stalks, and recycled manure solids (62, 68, and 65% of applied urine N, respectively), whereas emissions from chopped wheat straw (55% applied urine N) only differed significantly from that from sand. Differences in the chemical characteristics of the beddings did not explain differences in emission; NH₃ emissions increased linearly with CEC contrary to expectations, and there was no significant relationship with initial bedding pH. The physical characteristics of bedding materials were of more importance, as NH₃ emissions increased linearly with absorbance capacity and decreased as the bulk density of the packed beddings increased.

Key words: ammonia emission, bedding material, cattle, urine

Abbreviation key: CEC, cation exchange capacity, TAN, total ammoniacal N