A mathematical model for anaerobic degradation of complex organic material, such as manure, has been developed. The model includes an enzymatic hydrolytic step and four bacterial steps and involves 12 chemical compounds. The model focuses on ammonia inhibition and includes a detailed description of pH and temperature characteristics in order to accurately simulate free ammonia concentration. Free ammonia and acetate constitute the primary modulating factors in the model. The model has been applied for the simulation of digestion of cattle manure in continuously stirred tank reactors (CSTRs), and results compare favorably with experimental data. © 1993 John Wiley & Sons, Inc. Key words: anaerobic digestion ammonia inhibition manure mathematical model.

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