Forecasting Water Quality of Collected Runoff from Windrow Composting Pad: Probabilistic Approach

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Abstract. Having a composting option is important to certain industrial sectors of interest to Georgia. Extension/outreach personnel in Georgia estimate that there are some 40 to 50 windrow composting facilities in the state of Georgia. Many are not situated on a permitted sewage treatment location and, thus, require liquid waste permitting. Land application system (LAS) is an approved approach for discharging effluent of a pond where runoff is collected in order to prevent the discharge of organic pollutants. Runoff flow from the composting pad is highly regulated due to pollution potential. In late summer months, water quality of pond effluent often exceeds limits. The main objective of this study is predicting water quality of stored runoff from windrow composting system. Forecasting water quality of collected runoff helps to better manage LAS pond especially during the summer period. We used existing observation data of precipitation, temperature, pond level, material volume on the pad, total suspended solids (TSS), biological oxygen demand (BOD) concentration levels recorded for ten years (from January 2001 to December 2009). In this study, we performed autocorrelation and cross-correlation analysis in order to identify relationship and correlation between variables. Using Hidden Markov Model (HMM) as a probabilistic approach, we predicted water quality constituents of stored runoff from the windrow compost pad. It shows that HMM captures the dynamics of time series and dictates that using HMM for time series analysis has a great potential. The analysis demonstrated that weather and windrow composting system data enable operators to anticipate potential permit violations. Based on the results, we suggest anticipating a problem (exceeding regulatory threshold limits of TSS and BOD) when high precipitation and pond volume occurred 10 months ago and air temperature increased 7 months ago, low waste volume 5 and 10 months ago. Thus, windrow composting pad system could have additional treatment options for effluent as activated sludge treatment. Alternatively, the water from the pond could be pumped back to the pad but for only short term and on emergency basis.