AN INVESTIGATION OF UV DISINFECTION OF FARM DAIRY WASTEWATER

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AN INVESTIGATION OF UV DISINFECTION OF FARM DAIRY WASTEWATER

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ABSTRACT

The development of New Zealand dairy farming industry is characterised by a trend towards more intensified farming operations (larger herd sizes). This is placing greater demand for freshwater uses and effluent discharges. To comply with the microbiological standards, wastewater from farm dairies may be disinfected. Ultraviolet irradiation provides one of the best alternatives to traditional disinfection technologies.

With the development of technology and the awareness of the hazards of disinfection by-products, UV irradiation is increasingly used successfully world-wide for both drinking and wastewater disinfection. Due to the lack of data on the nature of farm dairy wastewater, no information was available on the application of UV to dairy effluents.

Wastewater samples were collected from farm dairies and analysed for characteristics relative to UV disinfection. Suspended solids (SS) contributed to nearly half the COD and 80% of the turbidity of the pond treated wastewater. Colloidal material in the 0.22 to 1.0 micron range constituted nearly 18% of the COD and 15% of the turbidity of the raw pond effluent.

Farm dairy wastewater quality changed with season. With the commencing of milking season, wastewater suspended solids, COD, and turbidity increased sharply due to the increased influent loading. However, wastewater BOD was similar over the monitoring period. With the exception of temperature and pH, wastewater quality parameters monitored showed great variation among different sites. These variations may be due to the difference in farm operation and management.

Pond treated farm dairy wastewater could not be directly disinfected by UV due to the high suspended solids (317 mg/l), COD (809 mg/l) concentration, high turbidity (450 NTU) and low UV transmittance (0%/cm). Filtration through 1.2, 0.45, and 0.22 micron filter removed all suspended solids and most of the turbidity, but UV transmittance remained lower than 1%/cm. Alum coagulation followed by 0.45 micron filtration removed most of the colloidal material and improved UV transmittance up to 29%/cm. The dissolved organic matter was successfully removed by 0.5 g/l activated carbon (AC) adsorption following aluminium sulphate coagulation treatment. To reach 60%/cm UV transmittance, AC dose of 5 g/l was required for raw pond effluent. Bark and zeolite treatment removed ammonium from farm dairy wastewater. Bark and zeolite treatment did not greatly improve raw pond effluent UV transmittance at 254 nm. Ultracentrifugation at 10,500 g for one hour did not significantly improve UV transmission through alum coagulated farm dairy wastewater. Hydrogen peroxide was found not helpful in improving UV penetration. Strong correlation existed between UV absorbance and COD concentration. UV absorbance may be used as a parameter for estimating wastewater COD level.

Keywords: Farm dairy wastewater, ultraviolet (UV), disinfection, dilution, filtration, alum coagulation, hydrogen peroxide, activated carbon, UV transmittance.

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