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ANALYSIS OF STEROID HORMONES AND VETERINARY PHARMACEUTICALS IN WATER USING ON-LINE SOLID PHASE EXTRACTION LIQUID CHROMATOGRAPHY TANDEM MASS SPECTROMETRY

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ABSTRACT: The need for sensitive and reliable analytical methods for the detection of steroids, antibiotics, and other wastewater-related contaminants in environmental matrices is of pressing concern as more data is sought about the possible toxicological effects of these compounds. Contamination of surface water and groundwater from steroids and pharmaceuticals near urban areas or concentrated animal feeding operations (CAFOs) has the potential to impact aquatic organisms. These contaminants typically occur at low concentrations, even near sources, and in complicated matrices. In order to study impacts to the environment and biological organisms, it is necessary to develop a sensitive analytical method which can detect these contaminants at concentrations below which they are toxicologically significant. Analysis of these polar organic compounds at such low levels in complex matrices presents a significant challenge. The Water Sciences Laboratory at the University of Nebraska has developed methods for sensitive and compound specific analysis of contaminants associated with livestock waste. This method has been developed utilizing a commercial online solid phase extraction (SPE) system. On-line extraction/injection allows the automated extraction of multiple samples followed by direct injection of extracts onto the LC triple quadrupole mass spectrometer. Automated sample extraction and injection provides low method detection limits and reduces the amount of time spent on sample preparation and extraction. Method detection limits in water for both the steroid and antibiotic method range from 0.4 to 7 pg/g using electrospray ionization. Compounds in this method include those such as testosterone, 17beta-estradiol, progesterone, both 17alpha and 17beta-trenbolone, melengestrel acetate, and several sulfonamide antibiotics. The primary limitations for on-line SPE are co-extracted interference peaks and matrix suppression in electrospray ionization due to co-eluting matrix observed when applying this method to analysis of livestock wastewater samples. The use of a new atmospheric pressure photoionization (APPI) source may provide more energetic and selective ionization of compounds such as steroid hormones. The development of this method at the low ng/L level will allow for the sensitive and selective detection of these environmental contaminants in environmental samples.

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