Degradation Kinetics and Mechanism of Antibiotic Ceftiofur in Recycled Water Derived from a Beef Farm

Ceftiofur is used to treat respiratory diseases in cattle. It is typically injected into the muscle of cattle and is quickly metabolized to furoic acid and desfuroyiceftiofur (DFC), which has the same antibacterial properties as ceftiofur. Ceftiofur is either metabolized or excreted through urine and feces, and no trace of the drug is found in cattle one to two days after injection. Previous studies have shown that most of the ceftiofur is not metabolized and is excreted to manure. With liquid manure being recycled as fertilizer for crops, antibiotics entering the environment and increasing antibiotic resistance in bacteria or being absorbed into food crops is a concern.

ISTC's senior research scientist Wei Zheng collaborated with researchers from the Illinois State Water Survey, the U.S. Department of Agriculture, and the University of Illinois to determine the degradation kinetics of ceftiofur in liquid manure. Typically liquid manure is mixed with water to reduce the solids loading on the application system. The researchers mixed raw manure with water at concentrations from 1% to 5% manure. Then the mixtures were incubated at temperatures between 15 and 45°C. They found that ceftiofur hydrolysis and degradation increased with a higher manure concentration and incubation temperature. As a result of hydrolysis and biodegradation to DFC and cef-aldehyde (respectively), ceftiofur has less antibacterial activity, thereby reducing potential negative environmental impacts.

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