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Impact of agricultural practices on veterinary pharmaceutical occurrence in superficial waters

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Background and objectives

Diffuse contamination of surface water by veterinary pharmaceuticals (VP) has been poorly studied in intensive breeding context. Recycling animal waste on soil is supported to fertilize crops and reduce utilization of mineral fertilizer but may have some environmental impact by recycling pollutants on soils and transferring pollutants from soils to rivers. Most of pharmaceuticals are consumed indifferently by human and animal, especially antibiotics. This study aims to quantify veterinary pharmaceuticals (VP) in superficial water in two agricultural catchments. One is dedicated to the production of drinkable water. Agriculture but also waste water treatment plant may contribute to the contamination of water and it is difficult to distinguish animal versus human source of contamination.

Methods and results *

Grab and storm events water sampling were carried out from March 2013 to December 2014 on the 4,9 km² Kervidy-Naizin headwater catchment located in Brittany (western France) belonging to the AgrHyS environmental research observatories and part of Network in Drainage Basins. Water quality is impacted by intensive breeding (swine, cattle) with mean nitrate concentration of about 80 mg/l. Grab sampling were performed on different sub catchments from 2 to 80 km² located in Ille et Vilaine, impacted both by agricultural diffuse pollution and a sewage treatment plant. Priorization of molecules was established by a veterinary survey.

On Kervidy-Naizin, Thrimethoprim, Oxytetracyclin and Enrofloxacin are frequently quantified (from 57 to 42%). Mean and max concentrations respectively (12 to 80 ng/l) and (20 to 230 ng/l) are identical in flood and non-flood events. The frequency of quantification of Eprinomectin, a cattle veterinary antimicrobial, is 31% and mean concentration is high (400 ng/l). On the Ille et Vilaine catchment, human pharmaceuticals are frequently quantified Diclofenac (77%), et Carbamazepin (55%). But human/veterinary Flunixin (69 %), Lincomycin (56%) and Fluméquin (55%) or specifically veterinary ,Sulfaméthazin (67%), are also quantified. Cumulated concentrations ranged from 1 to 3178 ng/L on Kervidy Naizin and 8 to 2500 ng/L on Ille et Vilaine site. Maximum VP concentrations are associated to the transfer of one or two molecules, mostly antimicrobial. High temporal variability of the nature of the molecules and the concentration were observed during the seven storm events.

Discussion and conclusion

Specifically veterinary pharmaceutical were quantified in both sites and particularly in headwater catchments above the plant. The impact of agricultural practices on water contamination by VP was confirmed. Presence of human/veterinary molecules suggested that diffuse agricultural pollution may really contribute to the presence of pharmaceutical in water but it is difficult to identify the main sources.

Keywords : veterinary pharmaceutical, catchment, agriculture, farming waste, storm event.