

Antibiotic residues in local crops irrigated with tertiary wastewater from Tubli Water Pollution Control Centre (WPCC) in The Kingdom of Bahrain

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ABSTRACT

Concerns to the presence of antibiotics in wastewater are pertained to the facts that certain number of antibiotics are resistant to microbial degradation, photolysis, and chemical oxidation. The current works assess the presence of selected antibiotic residues in different soil and plant samples irrigated

with tertiary wastewater. Samples of soil and the leafy/edible part of the following local crops were collected from different fields that use tertiary wastewater for irrigation: *Raphanus sativus*, *Raphanus raphanistrum*, *Allium cepa*, *Carum petroselinum*, *Mentha suaveolens* and *Anethum graveolens*. Samples (soil/root/leaf) were analyzed using the tandem mass spectrometric analysis (LC-MS/MS) technology with limits of detections (LOD) equals to 10 ppb. The study indicated absence of antibiotic residues in tested soil samples and plant tissues.

Key Words: Antibiotic residues; Tertiary wastewater; Crops

Several studies indicated the presence of antibiotic residues in wastewater from municipal effluents (1-3). Concerns to the presence of antibiotics in wastewater are pertained to the facts that certain number of antibiotics are resistant to microbial degradation, photolysis, and chemical oxidation (2). Furthermore, antibiotics in wastewater are present in sub-therapeutic levels prompting for antibiotic resistance and consequently possessing threats to human health (2,3). Therefore, excessive use of antibiotics in current medical and agricultural amenities needs proper monitoring to assess and reduce the risk coming from accumulation of antimicrobial agents. The current work assess the presence of selected antibiotic residues in different soil and plant samples irrigated with tertiary wastewater. The antibiotics investigated were danofloxacin, erythromycin, flubendazole, flumequine, tylosin and oxytetracycline. These are either administrated to treat patients or maintain health of livestock (personal communication with Environmental Authorities and Ministry of Health). The excreted antibiotics are either found in their parent compound forms or in their conjugated forms (2).

METHODS

Collection of samples

Samples of soil and the leafy/edible part of the following local crops were collected from different fields that use tertiary wastewater for irrigation: *Raphanus sativus*, *Raphanus raphanistrum*, *Allium cepa*, *Carum petroselinum*, *Mentha suaveolens* and *Anethum graveolens*. Location of the studied fields is 26.187572, 50.461714. Samples were collected between middle of January and beginning of February 2018, were most of the above crops are harvested for local markets during early spring. Samples were three replicates of soil (600 grams) from three different fields that use tertiary wastewater for irrigation and three replicates of 50 grams of the crops list above. A fourth field was selected as the negative control for crops irrigated with groundwater. Samples collected from the control field were three replicates of 600 grams of soil and 50 grams of the same plant species used in the test experiments. No irrigation water samples were analyzed in this study as the annual municipal effluents are under continues change, making detection of antibiotic residues very difficult (1,2). While, the high sorption abilities of certain acidic soils is considered more reliable in monitoring changes and accumulation of antibiotic residues in the environment (1).

Experimental procedure for half-life: Samples were prepared and analyzed according previous protocols (4). 10 grams of homogenized samples (soil/root/leaf) were analyzed using the tandem mass spectrometric analysis (LC-MS/MS) technology and limits of detections (LOD) were 10 ppb.

RESULTS AND DISCUSSION

Previous studies showed that radish (*Raphanus raphanistrum*) has high antibiotic half-lives/adsorption capabilities compared to other crops (4,5). However, the focus of the current study was on local crops with no preferences to whether their tissues are known to adsorb and accumulate antibiotic residues. The selected antibiotics are widely used to maintain health of livestock in dairy farms. The current study indicated no antibiotic residues in tested soil samples or plant tissues. Possible, reasons for the negative results could be attributed to the alkaline conditions posed by the use of manure and the increase in soil pH advised by the presence of high ammonia concentrations (1). Another reason attributes the low concentrations of antibiotics in soil samples to the mobility of certain antibiotics and being leached to surface or groundwater (1).

The selected antibiotics in this study are widely used to maintain health of livestock in dairy farms. The obtained results indicated absence of antibiotics in tested soil samples and plant tissues. Possible, reasons for the negative results could be attributed to the alkaline conditions posed by the use of manure as fertilizer during the spring season. Another reason is the leach of antibiotics to surface or groundwater.

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