Erratum to: Antibiotics and Antibiotics Resistance Genes in Soils

Monitoring, Toxicity, Risk Assessment and Management

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Erratum to:
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The original version of this book contains errors which have been corrected. The corrections are given below:

Chapter 3: A Review on Antibiotics Consumption, Physico-Chemical Properties and Their Sources in Asian Soil

The contents of the following sub-headings have been updated:

1) **Abstract**
2) **3.1 Introduction**
3) **3.2 Antibiotics: How Does It Work?**
4) **3.3.2 Livestock and Agricultural Usage**
5) **3.4.1 Tetracycline and Sulfonamides**
6) **3.4.2 Fluoroquinolones**
7) **3.4.3 Macrolides**
8) **3.4.4 Aminoglycoside**
9) **3.5 Sources of Antibiotics in Asian Soil**
10) **3.6 Occurrence of antibiotics in Asian soil**

The following subheadings and their contents have been added to the chapter:

3.6 Occurrence of Antibiotics in Asian Soil

From the sources discussed previously in this chapter, it is evident that antibiotics can end up in the soil, and finally via plant uptake, such chemicals may enter the food chain. Despite such existing sources, limited data is available on the level of antibiotics in Asian soil. Antibiotic levels in soil in China and Korea among Asian countries have been given in Table 3.5. All the tetracycline compounds showed highest range in Shenyang region, China. Agriculture, animal husbandry, and agricultural product processing units were dominant in north-eastern part of Shenyang city. Sulfonamide compounds also showed very high concentration in Shenyang city. Sulfonamides and tetracycline are the two antibiotics most commonly used to promote growth in livestock production. So it is evident that the high concentration of these two compounds in Shenyang city is due to the use of these two antibiotics in livestock production. As compared to China, the antibiotic concentration in Korean soil is less. This may be because, since 2005, South Korea is gradually decreasing the use of antibiotic growth promoters in livestock production.

3.7 Conclusion

Like several other organic pollutants, anitibiotics also reach soil mostly after partially treated or untreated antibiotics present in wastewater stream. Studies across the globe have reported the uptake of antibiotics by plants. The pathway of these pollutants generally depends on its physio-chemical properties. Studies have shown the development of antibiotic resistance genes in soil, plants, and humans. Further studies are required to find the fate of these pollutants in the environment and the associated risk due to the occurrence of these antibiotics in the environment.

The following tables have been added to the chapter:

Table 3.2 Physico-chemical properties and structure of antibiotics

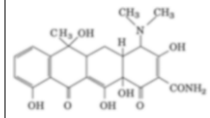
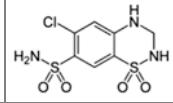
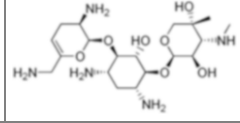
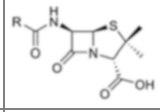
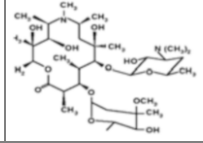
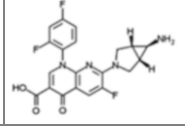
Class	Molar mass (g/mol)	Water solubility (mg/L)	Log Kow	pKa	Henry's constant (Pal/mol)	Structure
Tetracycline	444.5–527.6	230–52,000	−1.3 to 0.05	3.3/7.7/9.3	1.7×10^{-23}–4.8×10^{-22}	
Sulfonamides	172.2–300.3	7.5–1500	−0.1 to 1.7	2–3/4.5–10.6	1.3×10^{-12}–1.8×10^{-8}	
Aminoglycosides	332.4–615.6	10–500	−8.1 to −0.8	6.9–8.5	8.5×10^{-12}–4.1×10^{-18}	
ß-Lactam	334.4–470.3	22–10,100	0.9–2.9	2.7	2.5×10^{-19}–1.2×10^{-12}	
Macrolides	687.9–916.1	0.45–15	1.6–3.1	7.7–8.9	7.8×10^{-36}–2.0×10^{-26}	
Fluoroquinolones	229.5–417.6	3.2–17,790	−1.0 to 1.6	8.6	5.2×10^{-17}–3.2×10^{-8}	

Table 3.3 Antibiotics in the sludge from wastewater treatment plant used as manure

Compounds	Sludge (μg/g)	Country	Reference
Tetracycline			
Tetracycline	2174.46	Sheyang, China(NE)	An et al. (2015)
Oxytetracycline	7369.67	Sheyang, China(NE)	An et al. (2015)
Chlortetracycline	3843.79	Sheyang, China(NE)	An et al. (2015)
Doxycycline	2104.27	Sheyang, China(NE)	An et al. (2015)
Sulfonamides			
Sulfamethoxazole	665	Sheyang, China(NE)	An et al. (2015)
Sulfadiazine	50.32	Sheyang, China(NE)	An et al. (2015)
Sulfamerazine	37.21	Sheyang, China(NE)	An et al. (2015)
Sulfadimidine	27.14	Sheyang, China(NE)	An et al. (2015)

Table 3.4 Antibiotics from livestock excreta used as manure

Compounds	Livestock manure (mg/g)	Country	Reference
Tetracycline			
Tetracycline	56.95	Sheyang, China(NE)	An et al. (2015)
	43.5	North China	Hu et al. (2010)
	3.5	Beijing	Li et al. (2015)
Oxytetracycline	47.25	Sheyang, China(NE)	An et al. (2015)
	183.5	North China	Hu et al. (2010)
	23.271	Beijing	Li et al. (2015)
Chlortetracycline	143.97	Sheyang, China(NE)	An et al. (2015)
	26.8	North China	Hu et al. (2010)
	26.218	Beijing	Li et al. (2015)
Doxycycline	6.5	Sheyang, China(NE)	An et al. (2015)
Fluoroquinolones			
Enrofloxacin	8.684	Beijing	Li et al. (2015)
Ciprofloxacin	4.3	North China	Hu et al. (2010)
	9.342	Beijing	Li et al. (2015)
Norfloxacin	4.187	Beijing	Li et al. (2015)
Ofloxacin	15.7	North China	Hu et al. (2010)
Perfloxacin	24.7	North China	Hu et al. (2010)
Lomefloxacin	0.038	Beijing	Li et al. (2015)
Macrolide			
Roxithromycin	0.067	Beijing	Li et al. (2015)
Lincomycin	3.8	North China	Hu et al. (2010)
Sulfonamides			
Sulfamethoxazole	18.5	Sheyang, China(NE)	An et al. (2015)
	5.7	North China	Hu et al. (2010)
	0.102	Beijing	Li et al. (2015)

(continued)

Table 3.4 (continued)

Compounds	Livestock manure (mg/g)	Country	Reference
Sulfadiazine	4.98	Sheyang, China(NE)	An et al. (2015)
	0.022	Beijing	Li et al. (2015)
Sulfamerazine	4.59	Sheyang, China(NE)	An et al. (2015)
Sulfadimidine	1.95	Sheyang, China(NE)	An et al. (2015)
Sulfamethazine	0.061	Beijing	Li et al. (2015)
Sulfadoxin	32.7	North China	Hu et al. (2010)
Sulfachloropyridazine	2.76	North China	Hu et al. (2010)

Table 3.5 Wastewater containing antibiotics used for irrigation

Compounds	Wastewater (ng/l)	Country	Reference
Tetracycline			
Tetracycline	560	New York	Batt et al. (2006)
	48,000	Wisconsin, USA	Karthikeyan et al. (2006)
Oxytetracycline	47,000	Wisconsin, USA	Karthikeyan et al. (2006)
Fluoroquinolones			
Enrofloxacin	250	Wisconsin, USA	Karthikeyan et al. (2006)
Ciprofloxacin	10	USA	He et al. (2015)
	970	New York	Batt et al. (2006)
	310	Wisconsin, USA	Karthikeyan et al. (2006)
Norfloxacin	250	Wisconsin, USA	Karthikeyan et al. (2006)
Ofloxacin	9	USA	He et al. (2015)
Macrolide			
Erithromycin	3900	Wisconsin, USA	Karthikeyan et al. (2006)
Roxithromycin	1500	Wisconsin, USA	Karthikeyan et al. (2006)
Salfonamides			
Sulfamethoxazol	156	South Africa	Rahzia et al. (2012)
	1340	New York	Batt et al. (2006)
	310	Wisconsin, USA	Karthikeyan et al. (2006)
Sulfamethazine	50	China	Sun et al. (2014)
	300	Wisconsin, USA	Karthikeyan et al. (2006)

The following Figures have been updated:

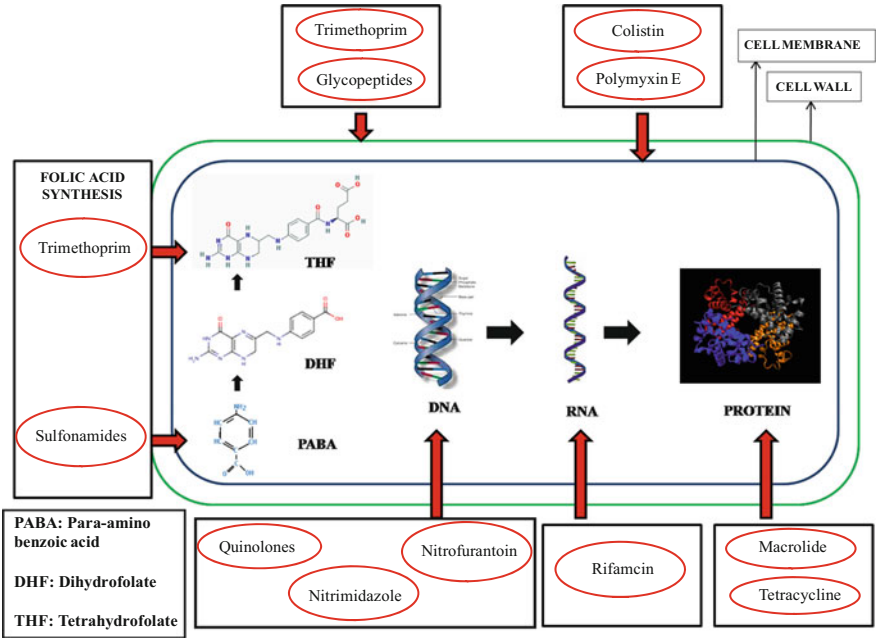


Fig. 3.1 Hypothetical schematic representation showing the mode of action of different antibiotics against bacteria

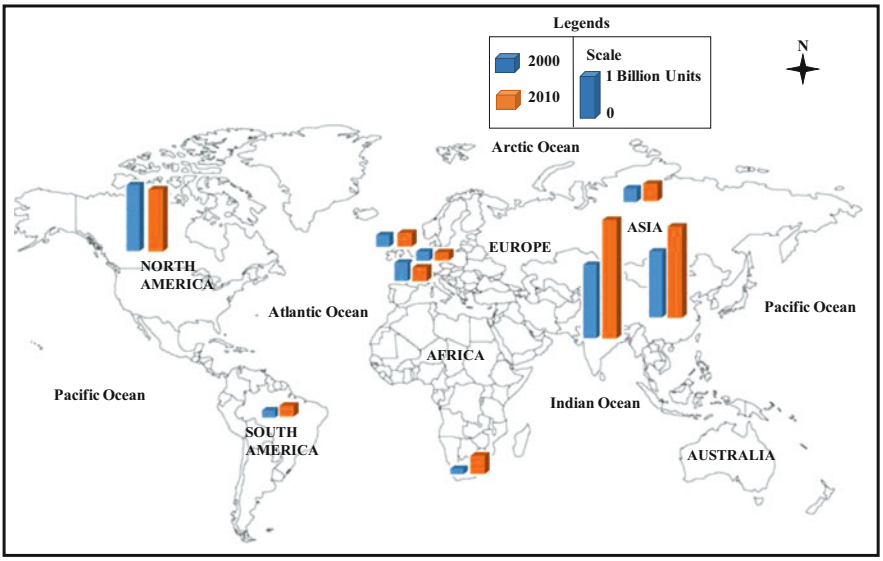


Fig. 3.2 Consumption of antibiotics by different countries across the globe during 2000 and 2010. (Data courtesy-Van Boeckel et al. 2015)

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Chapter 4: Entry Routes of Veterinary Antibiotics in the Environment
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Chapter 5: Monitoring of Antibiotics and Antibiotic Resistance Genes in Agroecosystems
The page numbers of the chapter has been updated to 71–96

Chapter 6: Role of Antibiotics in Climate Change
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Chapter 7: Potential Dissemination of ARB and ARGs into Soil Through the Use of Treated Wastewater for Agricultural Irrigation: Is It a True Cause for Concern?
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Chapter 8: Antibiotic Resistance Gene Due to Manure Application
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Chapter 9: Antibiotics and Antibiotics Resistance Genes Dissemination in Soils
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Chapter 10: Dissemination Mechanism of Antibiotic Resistance Genes in Environment
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Chapter 11: Fate of Antibiotics in Soil
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Chapter 12: Uptake of Antibiotics by Plants
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Chapter 13: Recent Advances in Methods for the Detection of Antibiotics and Antibiotics Resistance Genes in Soil
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Chapter 14: Elucidation of Emerging Nanomaterials Impacts on Antibiotic Resistance Against Soil and Aquatic Microflora
The page numbers of the chapter has been updated to 259–282

Chapter 15: The Effects of Antibiotics on the Structure, Diversity, and Function of a Soil Microbial Community
The page numbers of the chapter has been updated to 283–312

Chapter 16: Soil Antibiotics and Transfer of Antibiotic Resistance Genes Affecting Wildlife

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The contents of the following sub-headings have been updated:

1) **16.2 Interaction of Antibiotics with Soil**
2) **16.4 Antimicrobial Resistance in the Environment**
3) **16.5 The Problem of Antibiotic Resistance in Wild Animals**

The page numbers of the chapter has been updated to 313–326

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Chapter 18: Potential Environmental, Ecological and Health Effects of Soil Antibiotics and ARGs
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Chapter 19: Risk Assessment of Antibiotics and Antibiotic-Resistant Genes in Soil
The page numbers of the chapter has been updated to 367–386

Chapter 20: Antibiotics in the Soil: Sources, Environmental Issues, and Bioremediation
The page numbers of the chapter has been updated to 387–396

Chapter 21: Management and Regulation of Antibiotics and Antibiotics Resistance Genes in Soils
The page numbers of the chapter has been updated to 397–410

INDEX of the book has been updated.
The page numbers of the INDEX has been updated to 411–420