

**Table 1** Mass spectrometer parameters and LOQ for 55 veterinary drugs

NO	Compound	Group	EU MRLs <sup>a</sup> (µg kg <sup>-1</sup> )	RT <sup>c</sup> (min)	Transition (CE)	Fragmentor (V)	LOQ(µg kg <sup>-1</sup> )		
							Porcine	Bovine	Ovine
1	Albendazole	Benzimidazole	100 <sup>c</sup> , 100 <sup>d</sup>	17.1	266.1>234.1(20)*;266.1>191.1(35)	160	5	5	5
2	Albendazole sulfone	Benzimidazole	100 <sup>c</sup> , 100 <sup>d</sup>	11.1	298.1>159.1(60)*;298.1>224.1(35)	140	2.4	2.4	2.4
3	Albendazole sulfoxide	Benzimidazole	100 <sup>c</sup> , 100 <sup>d</sup>	8.1	282.1>240.1(15)*;282.1>208.1(40)	80	2.8	2.8	1.4
4	Albendazole-2-amino sulfone	Benzimidazole	100 <sup>c</sup> , 100 <sup>d</sup>	4.4	240.1>133.1(35)*;240.1>198.1(10)	140	1	1	1
5	Febantel	Benzimidazole	50 <sup>b</sup> , 50 <sup>c</sup> , 50 <sup>d</sup>	26.2	447.2>383.1(10)*;447.2>415.1(15)	100	1.8	3.6	1.8
6	Flubendazole-amine	Benzimidazole	50 <sup>b</sup>	10.7	256.1>95.1(60)*;256.1>123.1(40)	160	2	2	2
7	Levamisole	Benzimidazole	10 <sup>c</sup> , 10 <sup>d</sup>	4	205.1>178.1(20)*;205.1>91.1(45)	140	1	1	1
8	Mebendazole-5-hydroxy	Benzimidazole	60 <sup>d</sup>	9.8	298.1>266.1(15)*;298.1>79.1(40)	100	2	2	2
9	Mebendazole-amine	Benzimidazole	60 <sup>d</sup>	9.6	238.2>77.1(40)*;238.2>105.1(20)	160	2.4	1.2	1.2
10	Oxfendazole	Benzimidazole	50 <sup>b</sup> , 50 <sup>c</sup> , 50 <sup>d</sup>	12	316.1>159.1(25)*;316.1>191.1(10)	160	1	1	1
11	Oxibendazole	Benzimidazole	100 <sup>b</sup>	11.7	250.2>218.1(15)*;250.2>176.1(30)	80	10	10	10
12	Thiabendazole	Benzimidazole	100 <sup>c</sup>	5.78	202.1>175.0(30)*;202.1>131.1(35)	100	10	10	10
13	Thiabendazole-5-hydroxy	Benzimidazole	100 <sup>c</sup> , 100 <sup>d</sup>	3.9	218.1>147.1(30)*;218.1>191.1(40)	120	1.7	1.7	1.7
14	Clindamycin	Macrolide	-	12.4	425.2>126.1(40)*;425.2>377.1(10)	120	0.8	0.8	0.8
15	Josamycin	Macrolide	-	24.2	828.5>174.1(30)*;828.5>109.1(55)	200	0.6	0.6	0.3
16	Lincomycin	Macrolide	100 <sup>b</sup> , 100 <sup>c</sup> , 100 <sup>d</sup>	4.7	407.2>126.1(30)*;407.2>359.1(15)	160	10	10	10
17	Roxithromycin	Macrolide	-	23.4	837.6>158.1(35)*;837.6>680.1(5)	140	1	1	1
18	Tiamulin	Macrolide	100 <sup>b</sup>	21.9	494.3>192.1(20)*;494.3>119.1(45)	160	4	4	4
19	Tylosin	Macrolide	100 <sup>b</sup> , 100 <sup>c</sup> , 100 <sup>d</sup>	21.5	916.5>174.1(30)*;916.5>773.1(50)	240	5	5	5
20	Ciprofloxacin	Quinolone	100 <sup>b</sup> , 100 <sup>c</sup> , 100 <sup>d</sup>	6.7	332.2>314.2(15)*;332.2>231.2(35)	120	8	8	8
21	Difloxacin	Quinolone	400 <sup>b</sup> , 400 <sup>c</sup> , 400 <sup>d</sup>	9.7	400.1>382.1(20)*;400.1>356.1(15)	140	5.6	2.8	2.8
22	Enoxacin	Quinolone	-	6.2	321.2>303.1(10)*;321.2>232.1(30)	120	3.6	3.6	3.6
23	Enrofloxacin	Quinolone	100 <sup>b</sup> , 100 <sup>c</sup> , 100 <sup>d</sup>	7.9	360.2>342.1(10)*;360.2>316.1(10)	140	2	4	2
24	Fleroxacin	Quinolone	-	6.4	370.2>326.1(10)*;370.2>269.1(40)	140	2.6	2.6	2.6
25	Flumequine	Quinolone	200 <sup>b</sup> , 200 <sup>c</sup> , 200 <sup>d</sup>	18.5	262.1>244.1(15)*;262.1>202.1(35)	100	18.4	18.4	18.4
26	Lomefloxacin	Quinolone	-	7.4	352.2>308.1(10)*;352.2>265.1(40)	140	2.6	2.6	1.3
27	Marbofloxacin	Quinolone	150 <sup>b</sup> , 150 <sup>c</sup>	6.3	363.2>72.1(40)*;363.2>320.1(15)	120	1.7	1.7	1.7
28	Nalidixic acid	Quinolone	-	17.2	233.1>215.1(10)*;233.1>104.1(50)	80	3	3	3
29	Ofloxacin	Quinolone	-	6.6	362.2>318.2(10)*;362.2>261.1(40)	140	4	2	2
30	Orbifloxacin	Quinolone	-	8.2	396.2>352.1(10)*;396.2>295.1(5)	140	0.7	1.4	1.4
31	Sarafloxacin	Quinolone	-	9.5	386.1>342.1(10)*;386.1>299.1(35)	140	4	2	2
32	Sparfloxacin	Quinolone	-	10	393.2>349.1(15)*;393.2>292.1(20)	120	1.4	2.8	1.4
33	Sulfamethazine	Sulfonamide	100 <sup>b</sup> , 100 <sup>c</sup> , 100 <sup>d</sup>	7	280.0>186.0(10)*;280.0>156.1(10)	80	2	2	4
34	Sulfabenzamide	Sulfonamide	100 <sup>b</sup> , 100 <sup>c</sup> , 100 <sup>d</sup>	12.4	277.1>156.1(10)*;277.1>92.1(35)	80	10	20	10
35	Sulfacetamide	Sulfonamide	100 <sup>b</sup> , 100 <sup>c</sup> , 100 <sup>d</sup>	3.1	215.0>92.1(5)*;215.0>156.1(20)	60	5.6	5.6	5.6
36	Sulfachlorpyridazine	Sulfonamide	100 <sup>b</sup> , 100 <sup>c</sup> , 100 <sup>d</sup>	8.6	285.0>156.1(10)*;285.0>92.1(40)	80	4	4	8
37	Sulfadiazine	Sulfonamide	100 <sup>b</sup> , 100 <sup>c</sup> , 100 <sup>d</sup>	3.8	251.0>156.1(15)*;251.0>92.1(40)	100	2.4	2.4	4.8
38	Sulfadoxine	Sulfonamide	100 <sup>b</sup> , 100 <sup>c</sup> , 100 <sup>d</sup>	13.8	311.1>156.1(10)*;311.1>92.1(10)	100	2	4	4
39	Sulfafurazole	Sulfonamide	100 <sup>b</sup> , 100 <sup>c</sup> , 100 <sup>d</sup>	10.9	268.1>113.1(15)*;268.1>156.1(15)	100	3.6	3.6	7.2
40	Sulfamerazine	Sulfonamide	100 <sup>b</sup> , 100 <sup>c</sup> , 100 <sup>d</sup>	5.3	265.1>156.1(10)*;265.1>65.1(50)	80	2.4	2.4	4.8
41	Sulfameter	Sulfonamide	100 <sup>b</sup> , 100 <sup>c</sup> , 100 <sup>d</sup>	7	281.1>156.1(10)*;281.1>92.1(35)	100	1.3	2.6	2.6

NO	Compound	Group	EU MRLs <sup>a</sup> ( $\mu\text{g kg}^{-1}$ )	RT <sup>e</sup> (min)	Transition (CE)	Fragmentor (V)	LOQ <sup>f</sup> ( $\mu\text{g kg}^{-1}$ )		
							Porcine	Bovine	Ovine
42	Sulfamethizole	Sulfonamide	100 <sup>b</sup> , 100 <sup>c</sup> , 100 <sup>d</sup>	7.2	271.0>156.1(15)*;271.0>92.1(40)	80	4.6	4.6	9.2
43	Sulfamethoxazole	Sulfonamide	100 <sup>b</sup> , 100 <sup>c</sup> , 100 <sup>d</sup>	9.6	254.1>92.1(40)*;254.1>108.1(40)	100	2.2	4.4	4.4
44	Sulfamonomethoxine	Sulfonamide	100 <sup>b</sup> , 100 <sup>c</sup> , 100 <sup>d</sup>	6.9	281.0>156.1(10)*;281.0>65.1(50)	100	1.5	3	6
45	Sulfaphenazole	Sulfonamide	100 <sup>b</sup> , 100 <sup>c</sup> , 100 <sup>d</sup>	14.2	315.1>158.1(30)*;315.1>131.1(50)	120	4	4	4
46	Sulfapyridine	Sulfonamide	100 <sup>b</sup> , 100 <sup>c</sup> , 100 <sup>d</sup>	4.8	250.0>92.1(35)*;250.0>156.1(30)	80	2	4	4
47	Sulfaquinoxaline	Sulfonamide	100 <sup>b</sup> , 100 <sup>c</sup> , 100 <sup>d</sup>	14.3	301.1>156.1(10)*;301.1>92.1(30)	80	2	2	2
48	Sulfathiazole	Sulfonamide	100 <sup>b</sup> , 100 <sup>c</sup> , 100 <sup>d</sup>	4.5	256.0>156.1(15)*;256.0>92.1(40)	80	2	4	4
49	Sulfisomidin	Sulfonamide	100 <sup>b</sup> , 100 <sup>c</sup> , 100 <sup>d</sup>	3.5	279.1>186.1(10)*;279.1>124.1(5)	120	1.4	2.8	1.4
50	Trimethoprim	Sulfonamide	50 <sup>b</sup> , 50 <sup>c</sup> , 50 <sup>d</sup>	5.6	291.1>230.1(20)*;291.1>123.1(25)	120	5	5	5
51	Cimaterol	$\beta$ -agonist	-	2.4	220.1>160.1(10)*;220.1>143.1(40)	80	0.1	0.1	0.1
52	Clenbuterol	$\beta$ -agonist	0.1 <sup>b</sup>	9.7	277.2>203.0(15)*;277.2>132.1(30)	120	0.2	0.2	0.2
53	Mabuterol	$\beta$ -agonist	-	11.1	311.1>237.1(10)*;311.1>293.1(5)	100	0.1	0.1	0.1
54	Ractopamine	$\beta$ -agonist	-	6.9	302.2>107.1(35)*;302.2>121.1(20)	120	1	1	1
55	Salbutamol	$\beta$ -agonist	-	2.4	240.1>148.1(10)*;240.1>166.1(15)	80	0.1	0.1	0.1

<sup>a</sup> MRL: Maximum Residue Limits in porcine, bovine and ovine muscle from EU ( regulation 37/2010)

<sup>b</sup> Maximum Residue Limits in porcine muscle

<sup>c</sup> Maximum Residue Limits in bovine muscle

<sup>d</sup> Maximum Residue Limits in ovine muscle

<sup>e</sup> RT: retention time of analyte detected in standard solution

<sup>f</sup> LOQ( $\mu\text{g kg}^{-1}$ ): limits of quantification calculated as the concentration at S/N=10

-: no MRL has been established

\* Transition of quantitation ion; collision energies (eV) are given in brackets

**Table 2** Validation results of 55 veterinary drugs in three matrices

NO	Compound	SL <sup>a</sup> (µg kg <sup>-1</sup> )	Recovery <sup>b</sup> (rs <sup>c</sup> ) in Porcine (%)			Rs <sup>d</sup> (%)	Recovery <sup>b</sup> (rs <sup>c</sup> ) in Bovine (%)			Rs <sup>d</sup> (%)	Recovery <sup>b</sup> (rs <sup>c</sup> ) in Ovine (%)			Rs <sup>d</sup> (%)
			Low	Medium	High		Low	Medium	High		Low	Medium	High	
1	Albendazole	50	95(16)	65(21)	81(28)	48	71(14)	107(18)	119(7)	29	101(30)	124(20)	91(15)	24
2	Albendazole sulfone	6	78(10)	92(3)	113(5)	9	86(4)	115(7)	111(5)	12	111(5)	91(6)	106(3)	8
3	Albendazole sulfoxide	7	85(10)	82(7)	120(6)	10	82(8)	127(12)	114(5)	15	111(9)	100(8)	129(6)	7
4	Albendazole-2-amino sulfone	10	67(6)	88(4)	89(6)	4	76(6)	101(3)	95(5)	14	83(6)	83(7)	96(2)	7
5	Febantel	18	69(12)	61(25)	87(24)	31	73(18)	77(19)	107(12)	22	87(34)	111(30)	95(4)	30
6	Flubendazole-amine	10	74(22)	71(21)	69(32)	36	73(9)	119(33)	100(8)	19	87(22)	132(13)	105(4)	21
7	Levamisole	10	78(6)	98(4)	105(4)	4	90(6)	116(2)	108(3)	15	82(4)	92(3)	107(12)	4
8	Mebendazole-5-hydroxy	20	84(15)	130(4)	97(8)	26	83(16)	115(11)	108(3)	20	126(10)	100(9)	109(5)	10
9	Mebendazole-amine	12	76(17)	65(20)	70(26)	30	79(10)	106(24)	101(8)	32	136(19)	122(12)	94(4)	14
10	Oxfendazole	10	80(6)	88(2)	102(5)	5	81(7)	106(6)	114(3)	7	129(11)	96(8)	114(5)	8
11	Oxibendazole	100	97(13)	84(12)	90(14)	18	82(11)	114(15)	111(5)	18	112(15)	117(10)	108(7)	7
12	Thiabendazole	100	102(6)	86(6)	109(3)	11	117(7)	107(7)	111(4)	7	100(14)	82(10)	108(6)	15
13	Thiabendazole-5-hydroxy	17	78(5)	84(12)	87(8)	13	76(9)	101(18)	102(8)	18	102(13)	77(7)	81(7)	9
14	Clindamycin	8	73(18)	73(4)	84(12)	13	78(4)	79(6)	94(3)	8	81(12)	87(11)	92(16)	14
15	Josamycin	3	105(14)	72(12)	88(10)	16	53(20)	75(8)	90(7)	8	114(20)	109(8)	130(12)	11
16	Lincomycin	100	43(14)	44(2)	50(6)	16	45(6)	44(5)	52(6)	6	36(8)	41(10)	51(10)	15
17	Roxithromycin	10	83(11)	84(15)	84(11)	14	71(13)	78(11)	99(8)	10	119(14)	123(7)	109(5)	16
18	Tiamulin	40	101(7)	87(12)	89(17)	20	90(11)	94(11)	118(7)	15	137(17)	129(8)	105(3)	16
19	Tylosin	50	88(17)	69(5)	78(11)	27	66(20)	72(11)	91(7)	9	74(22)	82(9)	100(13)	12
20	Ciprofloxacin	20	105(9)	91(9)	96(7)	11	122(9)	96(17)	126(3)	15	107(8)	119(11)	127(10)	13
21	Difloxacin	14	90(12)	95(2)	107(7)	9	99(11)	106(8)	116(6)	14	100(12)	104(9)	99(4)	11
22	Enoxacin	9	80(12)	80(6)	86(4)	11	66(25)	84(6)	97(6)	10	71(13)	90(9)	83(2)	11
23	Enrofloxacin	20	100(15)	97(2)	101(6)	7	94(8)	94(10)	105(16)	7	90(8)	101(7)	94(4)	10
24	Fleroxacin	13	96(15)	98(3)	101(2)	3	94(6)	95(6)	111(2)	10	84(6)	94(6)	106(8)	7
25	Flumequine	184	97(12)	101(5)	112(6)	7	104(7)	102(7)	126(2)	12	116(7)	111(5)	101(6)	11
26	Lomefloxacin	13	95(11)	92(4)	96(6)	6	82(3)	97(9)	117(4)	11	85(10)	90(9)	83(7)	9
27	Marbofloxacin	17	84(12)	93(3)	100(4)	3	92(7)	95(5)	109(3)	9	79(5)	93(5)	90(5)	7
28	Nalidixic acid	30	101(11)	100(5)	118(9)	6	107(6)	98(9)	118(9)	8	107(5)	108(4)	101(6)	14
29	Ofloxacin	20	100(12)	91(3)	99(5)	5	86(9)	96(5)	111(2)	7	85(9)	94(5)	97(5)	8
30	Orbifloxacin	7	94(13)	101(3)	104(4)	5	103(5)	101(5)	115(7)	9	76(4)	94(7)	97(4)	7
31	Sarafloxacin	10	82(12)	91(7)	94(9)	11	82(23)	97(11)	113(5)	13	89(11)	96(14)	94(3)	15
32	Sparfloxacin	14	86(14)	90(7)	96(11)	7	94(12)	101(8)	116(6)	8	88(10)	94(10)	96(3)	9
33	Sulfamethazine	10	103(7)	102(4)	102(4)	20	85(9)	95(6)	106(6)	15	85(5)	87(7)	96(2)	11
34	Sulfabenzamide	100	83(23)	85(15)	99(12)	11	99(5)	95(19)	120(5)	20	77(10)	106(13)	103(6)	12
35	Sulfacetamide	14	71(18)	113(11)	106(7)	17	69(17)	84(17)	112(5)	16	84(12)	104(14)	106(10)	17
36	Sulfachlorpyridazine	20	85(8)	93(9)	99(11)	10	106(9)	94(17)	130(7)	13	99(9)	103(13)	109(5)	11
37	Sulfadiazine	12	86(13)	102(10)	103(9)	15	90(11)	96(18)	126(8)	19	96(10)	91(8)	104(4)	9
38	Sulfadoxine	10	71(16)	96(15)	105(14)	13	110(15)	95(20)	135(8)	21	82(15)	103(15)	97(6)	12
39	Sulfafurazole	18	96(14)	92(10)	105(9)	7	77(29)	109(16)	132(7)	12	92(13)	90(10)	82(18)	11
40	Sulfamerazine	12	77(16)	85(13)	93(6)	13	82(13)	88(15)	117(6)	16	75(11)	92(8)	113(6)	8
41	Sulfameter	13	83(15)	92(9)	108(5)	10	95(13)	89(18)	128(6)	19	70(9)	93(10)	113(5)	9

NO	Compound	SL <sup>a</sup> ( $\mu\text{g kg}^{-1}$ )	Recovery <sup>b</sup> (rs <sup>c</sup> ) in Porcine (%)			Rs <sup>d</sup> (%)	Recovery <sup>b</sup> (rs <sup>c</sup> ) in Bovine (%)			Rs <sup>d</sup> (%)	Recovery <sup>b</sup> (rs <sup>c</sup> ) in Ovine (%)			Rs <sup>d</sup> (%)
			Low	Medium	High		Low	Medium	High		Low	Medium	High	
42	Sulfamethizol	23	82(12)	92(12)	103(11)	15	73(14)	92(21)	130(8)	18	89(14)	92(10)	111(9)	10
43	Sulfamethoxazole	11	98(14)	92(9)	104(9)	7	93(10)	95(12)	132(5)	14	107(27)	100(10)	119(3)	8
44	Sulfamonomethoxine	15	89(14)	96(7)	96(7)	8	87(14)	104(14)	125(4)	11	70(9)	93(8)	111(7)	7
45	Sulfaphenazole	10	80(29)	84(20)	94(15)	10	109(14)	102(23)	136(7)	20	78(20)	116(13)	95(6)	15
46	Sulfapyridine	10	79(15)	100(12)	96(9)	12	96(12)	91(19)	131(7)	19	85(6)	103(8)	100(9)	8
47	Sulfaquinoxaline	10	71(26)	72(22)	87(25)	20	114(16)	97(28)	112(9)	27	77(34)	104(22)	104(9)	18
48	Sulfathiazole	10	85(14)	87(15)	94(11)	21	85(10)	97(20)	131(10)	19	95(10)	84(14)	112(6)	12
49	Sulfisomidin	14	90(10)	88(10)	94(7)	9	89(8)	89(20)	122(8)	17	64(13)	79(10)	100(14)	11
50	Trimethoprim	50	94(15)	87(1)	101(5)	7	83(18)	108(5)	106(3)	10	106(20)	88(7)	98(1)	8
51	Cimaterol	0.2	109(4)	97(5)	97(4)	6	107(20)	101(5)	110(7)	6	85(7)	89(6)	95(6)	9
52	Clenbuterol	0.4	118(8)	108(6)	96(11)	11	71(8)	102(7)	92(7)	17	92(17)	91(17)	117(12)	19
53	Mabuterol	0.2	74(17)	93(9)	103(7)	8	89(16)	108(12)	101(2)	18	91(12)	100(8)	112(6)	11
54	Ractopamine	10	74(4)	88(7)	99(6)	9	78(11)	112(5)	106(6)	25	90(15)	99(7)	96(6)	9
55	Salbutamol	0.2	83(8)	87(10)	84(6)	11	61(16)	89(8)	89(9)	15	59(15)	64(6)	85(4)	11

<sup>a</sup>SL( $\mu\text{g/kg}$ ): spiked level is the concentration spiked to sample

<sup>b</sup>Recovery: the recovery of the spiked sample expressed as percentage

<sup>c</sup>rs(%): repeatability expressed as the relative standard deviation in three matrices (n=6) on 1 day

<sup>d</sup>Rs(%): reproducibility expressed as the relative standard deviation in three matrices (n=6) on 3 days