

1 **RSC Advances**

2 Supplementary information

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4 **On the ozonation of anti-SARS-CoV-2 substances and their nucleoside ana-**
5 **logues for mechanistic understanding of the ozone induced transformation us-**
6 **ing HPLC-ESI-Q-TOF-HRMS**

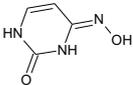
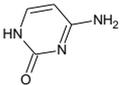
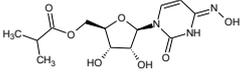
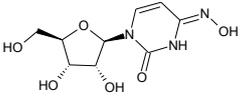
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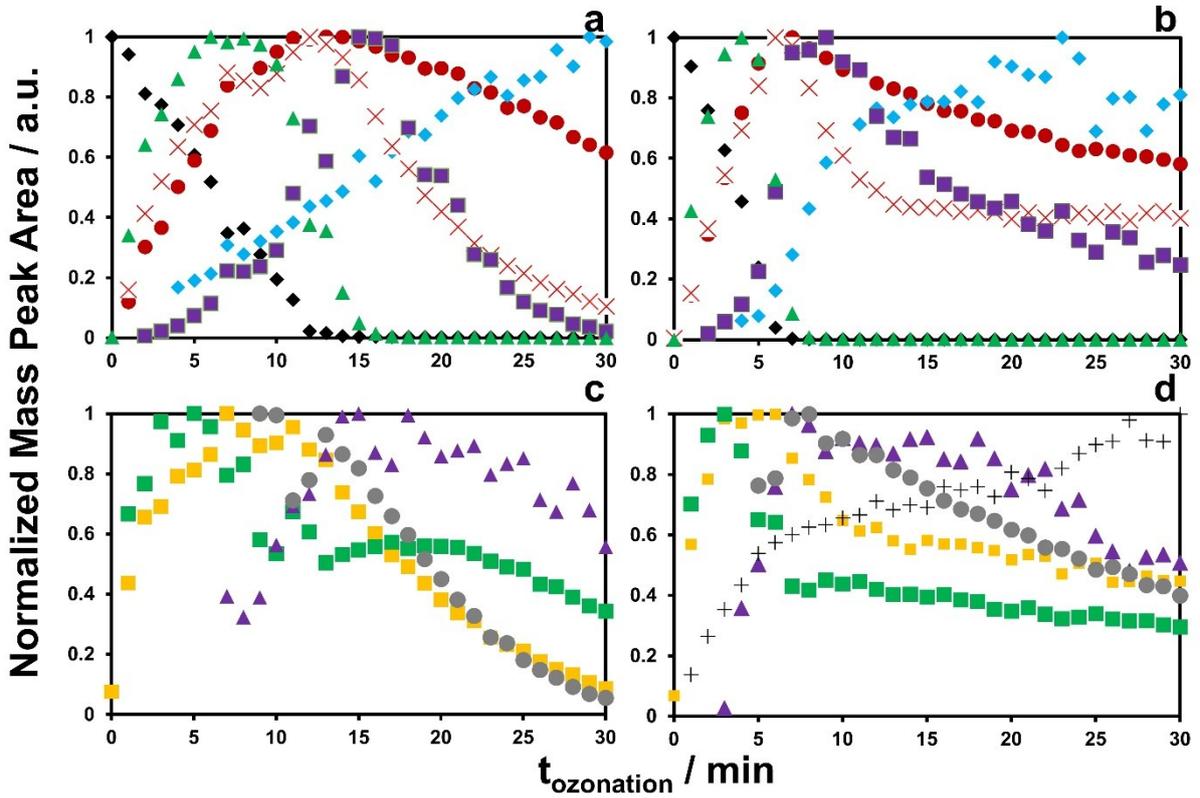
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18**Table A. 1: Substances measured in positive mode, their structural and molecular formula, as well as the exact and accurate mass of the quasi molecular ion $[M+H]^+$ and the relative mass accuracy $\delta m/m$ in ppm.**

substance	structure	molecular formula	$[M+H]^+$		$\delta m/m$ / ppm
			exact	accurate	
N ⁴ -hydroxycytosine		C ₄ H ₅ N ₃ O ₂	128.0455	128.0476	16.40
cytosine		C ₄ H ₅ N ₃ O	112.0505	112.0524	16.96
uracil		C ₄ H ₄ N ₂ O ₂	113.0346	113.0351	4.42
pyrimidine-2-one		C ₄ H ₄ N ₂ O	97.0396	97.0399	3.09
molnupiravir		C ₁₃ H ₁₉ N ₃ O ₇	330.1296	330.1361	19.69
EIDD-1931		C ₉ H ₁₃ N ₃ O ₆	260.0877	260.0766	42.68

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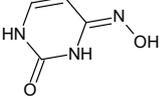
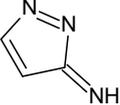
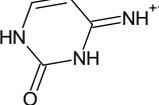
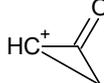
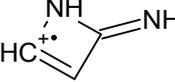
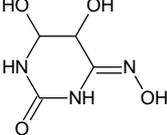
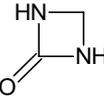
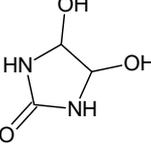
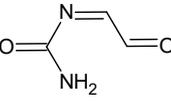


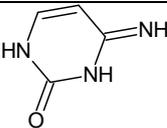
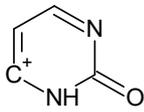
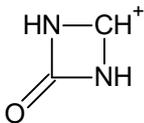
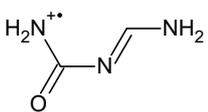
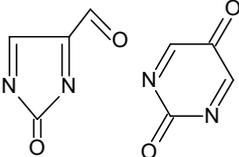
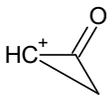
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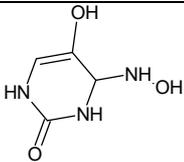
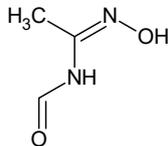
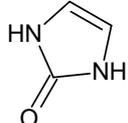
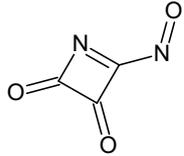
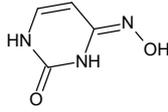
22 Figure A. 1: Degradation curves during ozonation of N⁴-hydroxycytosine in deionized H₂O (a) and in +10%
 23 BuOH (b) with parent drug N⁴-hydroxycytosine [M+H]⁺ = 128.0473 (black diamonds), and TPs
 24 [M+H]⁺ = 162.0511 (red circles), [M+H]⁺ = 111.0170 (blue diamonds), [M+H]⁺ = 113.0351 (red crosses),
 25 [M+H]⁺ = 226.0571 (purple squares), [M+H]⁺ = 222.0629 (green triangles) (a,b), and TPs [M+H]⁺ = 182.0176
 26 (purple triangles), [M+H]⁺ = 128.0456 (gray circles), [M+H]⁺ = 112.0508 (yellow squares), [M+H]⁺ = 146.0563
 27 (green squares) (c,d), and TP [M+H]⁺ = 191.0000 (black crosses) (d).

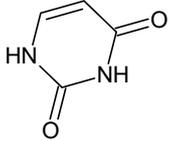
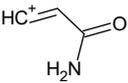
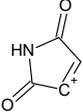
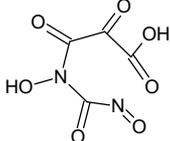
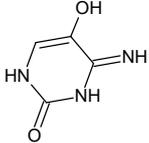
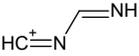
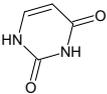
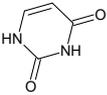
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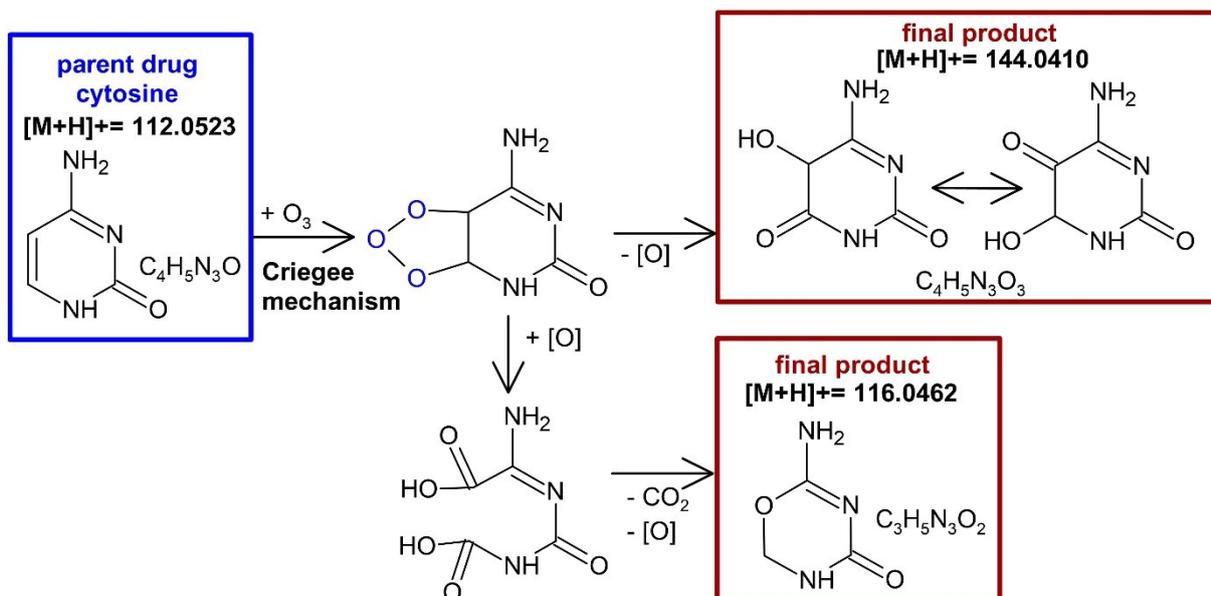
29 Table A. 2: N⁴-hydroxycytosine ([M+H]⁺= 128.0473) and its observed transformation products (TPs) formed
 30 during ozonation including retention time (*R_t* / min), MS/MS fragmentation patterns, proposed molecular
 31 structures, and mass accuracy ($\delta m/m$ / ppm). TPs without proposed structures were marked as not avail-
 32 able (n.a.), as more investigations should be necessary for clarification. *m/z* values without proposed frag-
 33 ment structures are shown in parentheses.

[M+H] ⁺	<i>R_t</i> / min	proposed structure	MS/MS fragments	$\delta m/m$ / ppm
128.0473	2.015		[M+H] ⁺ = 82.0399  M ⁺ = 111.0425  M ⁺ = 55.0923  M ⁺ = 68.0367 	14.84
162.0511	1.262		(56.0135) [M+H] ⁺ = 73.0393  [M+H] ⁺ = 119.0443  [M+H] ⁺ = 101.0335 	1.04

$[M+H]^+$	R_t / min	proposed structure	MS/MS fragments	$\delta m/m$ / ppm
112.0508	1.469		$M^+ = 95.0236$  $M^+ = 71.0240$  $M^{*+} = 87.0182$ 	2.68
111.0170	1.833		$M^+ = 55.0168$  (67.9346)	17.11

$[M+H]^+$	R_t / min	proposed structure	MS/MS fragments	$\delta m/m$ / ppm
146.0563	1.833		$[M+H]^+ = 103.0496$  (57.0449) $[M+H]^+ = 85.0398$  $[M+H]^+ = 112.9547$  $[M+H]^+ = 128.0455$ 	2.05

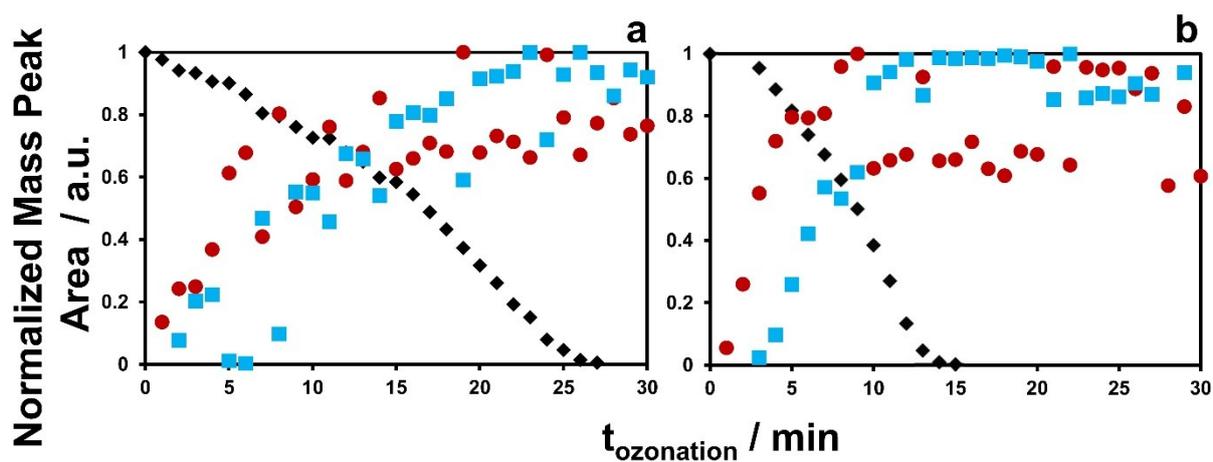
$[M+H]^+$	$R_t /$ min	proposed structure	MS/MS fragments	$\delta m/m /$ ppm
182.0176	2.042	n.a.	(97.9681) (56.9420)	n.a.
113.0351	2.407		$M^+ = 70.0286$  $M^+ = 96.0079$ 	4.83
191.0000	3.523		(84.9589, 129.0001, 56.9414)	34.15
128.0456	4.156		$M^+ = 55.0543$  (72.9367) (112.1006)	1.15
226.0571	6.721	n.a.	$[M+H]^+ = 113.0339$  (70.0294) (96.0082) (138.9638)	n.a.
222.0629	7.321	n.a.	$[M+H]^+ = 113.0344$ 	n.a.



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41 Figure A. 2: Proposed reaction mechanism of the ozonation of cytosine leading via the intermediate products to the final product *i.e.*, whose *c-t* curves no longer change during the observation period, cf. Figure
42 A. 3 red circles and blue squares.
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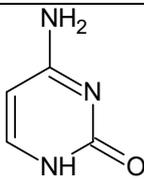
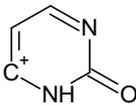
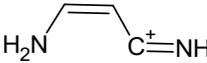
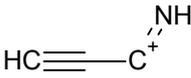
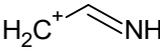
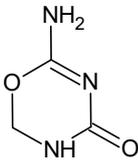
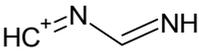
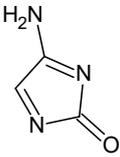


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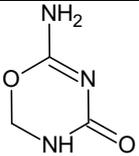
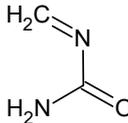
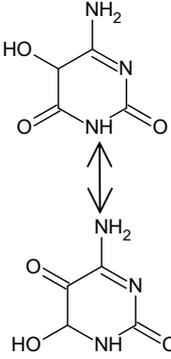
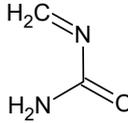
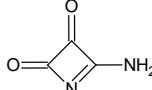
46 Figure A. 3: Degradation curves during ozonation of cytosine in deionized H₂O (a) and in +10% BuOH (b)
47 with parent drug cytosine [M+H]⁺= 112.0523 (black diamonds), and TPs [M+H]⁺= 116.0462 (red circles) and
48 [M+H]⁺= 144.0410 (blue squares).

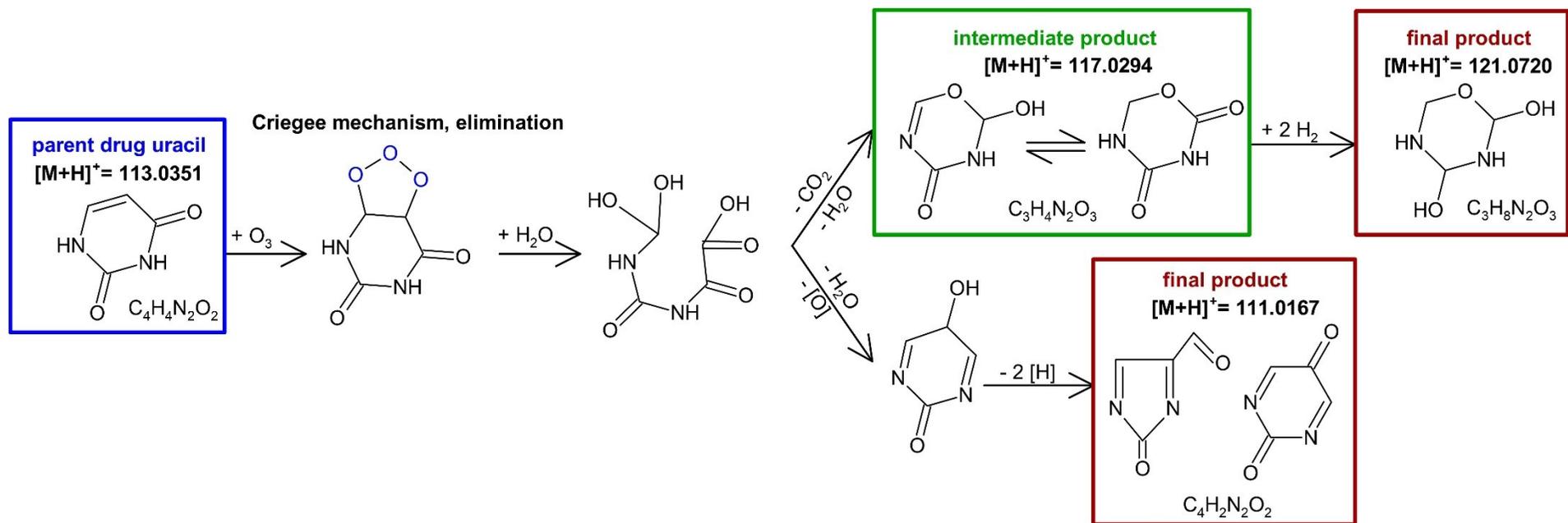
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Table A. 3: Cytosine ($[M+H]^+ = 112.0523$) and its observed transformation products (TPs) formed during ozonation including retention time (R_t / min), MS/MS fragmentation patterns, proposed molecular structures, and mass accuracy ($\delta m/m$ / ppm).

$[M+H]^+$	R_t / min	proposed structure	MS/MS fragments	$\delta m/m$ / ppm
112.0523	1.463		$M^+ = 95.0247$  $M^+ = 69.0453$  $M^+ = 52.0188$  $M^+ = 42.0345$ 	16.06
116.0462	1.245		$M^+ = 55.0296$  $[M+H]^+ = 98.0351$ 	6.44

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$[M+H]^+$	R_t / min	proposed structure	MS/MS fragments	$\delta m/m$ / ppm
116.0462	1.245		$[M+H]^+ =$ 73.0396 	6.44
144.0410	1.931		$[M+H]^+ =$ 73.0399  $[M+H]^+ =$ 44.0137 	4.17
			$[M+H]^+ =$ 99.0194 	

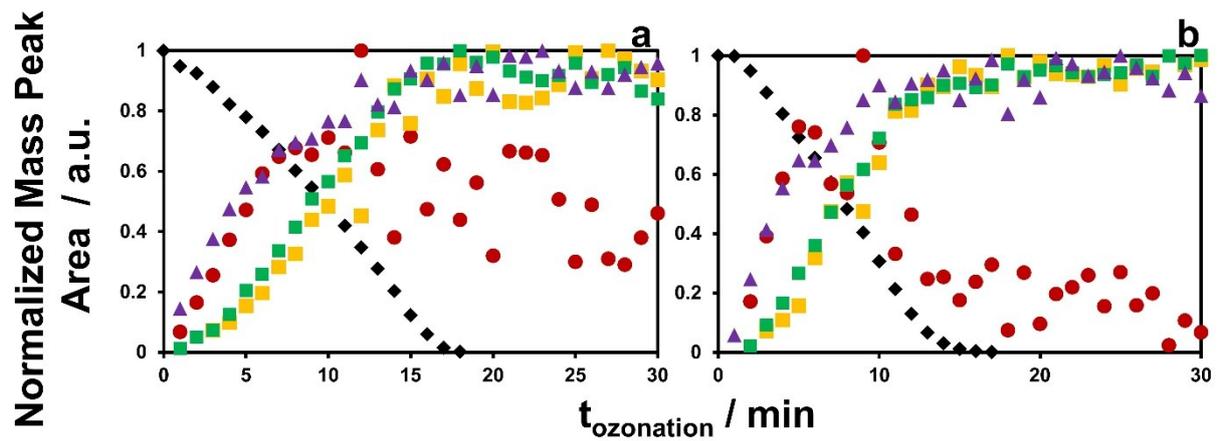


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Figure A. 4: Proposed reaction mechanism of the ozonation of uracil leading via the intermediate products to the final products *i.e.*, whose *c-t* curves no longer change during the observation period, *cf.* Figure A. 5 yellow squares and purple triangles.



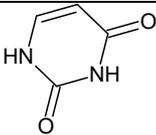
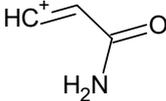
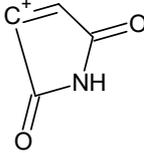
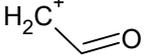
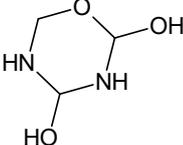
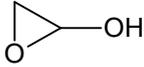
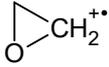
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59 Figure A. 5: Degradation curves during ozonation of uracil in deionized H₂O (a) and in +10% BuOH (b) with
 60 parent drug uracil [M+H]⁺= 113.0351 (black diamonds), and TPs [M+H]⁺= 117.0293 (red circles),
 61 [M+H]⁺= 121.0720 (yellow squares), [M+H]⁺= 293.0311 (green squares) and [M+H]⁺= 111.0167 (purple tri-
 62 gles).

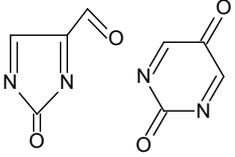
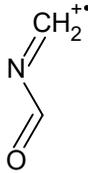
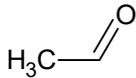
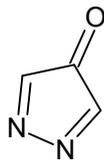
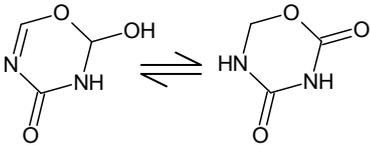
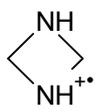
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65 Table A. 4: Uracil ($[M+H]^+ = 113.0351$) and its observed transformation products (TPs) formed during ozona-
 66 tion including retention time (R_t / min), MS/MS fragmentation patterns, proposed molecular structures, and
 67 mass accuracy ($\delta m/m$ / ppm). TPs without proposed structures were marked as not available (n.a.), as more
 68 investigations should be necessary for clarification. m/z values without proposed fragment structures are
 69 shown in parentheses.

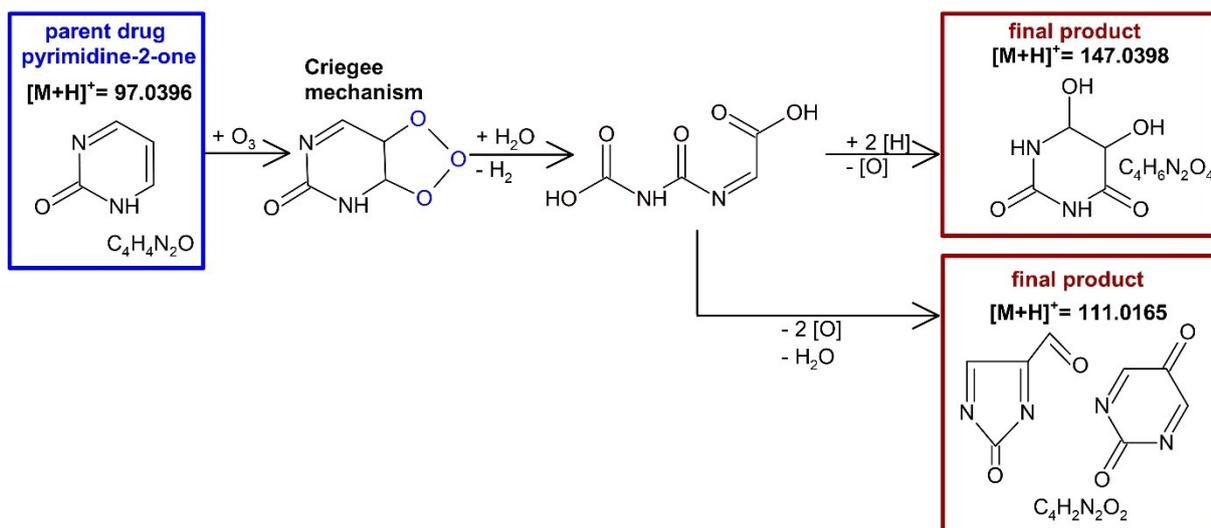
$[M+H]^+$	R_t / min	proposed structure	MS/MS fragments	$\delta m/m$ / ppm
113.0351	2.381		$M^+ = 70.0293$  $M^+ = 96.0086$  $M^+ = 43.0187$ 	4.83
121.0720	1.309		$[M+H]^+ = 61.0401$  $M^{*+} = 44.0134$ 	92.78
293.0311	1.497	n.a.	(202.0611) (156.0376) (111.0214) (171.0421) (193.0568) (221.0339)	n.a.

71 Table A. 4 continued

$[M+H]^+$	R_t / min	proposed structure	MS/MS fragments	$\delta m/m$ / ppm
111.0167	1.835	 <p>molecular formula: C₄H₂N₂O₂</p>	$M^{*+} = 57.0338$  $[M+H]^+ = 45.0340$  $[M+H]^+ = 82.9804$ 	19.85
117.0294	1.528		$M^{*+} = 58.0655$ 	0.58

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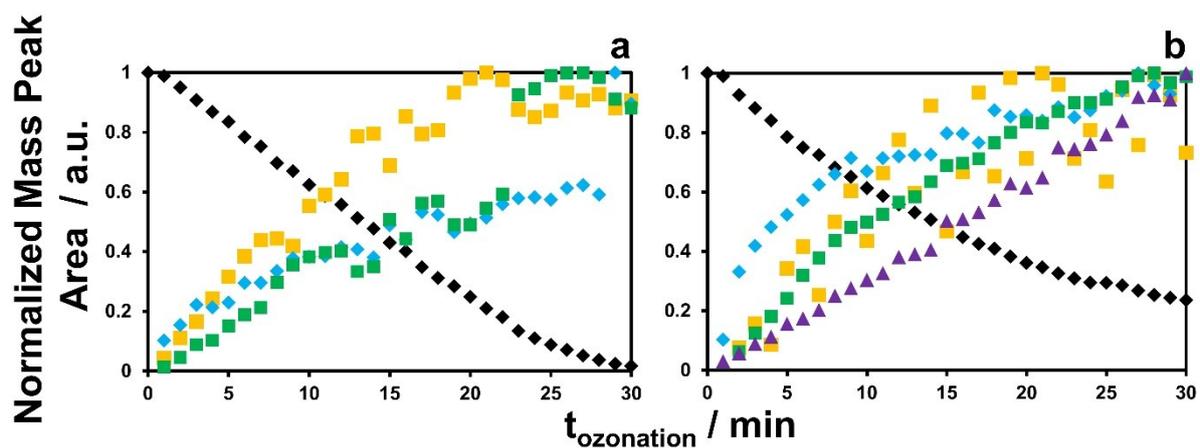
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74

75 Figure A. 6: Proposed reaction mechanism of the ozonation of pyrimidine-2-one leading via the interme-
76 diate products to the final products *i.e.*, whose *c-t* curves no longer change during the observation period,
77 *cf.* Figure A. 7 yellow squares and blue diamonds.

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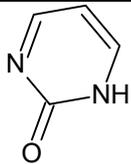
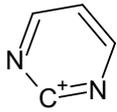
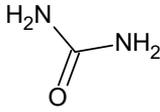
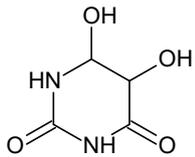
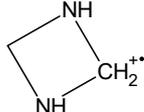
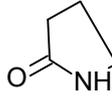
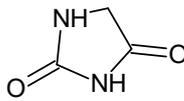
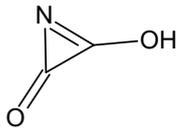


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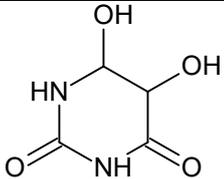
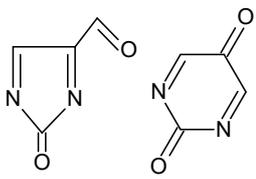
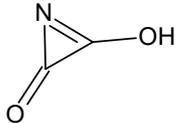
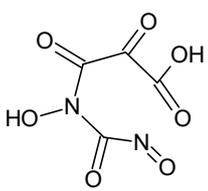
80 Figure A. 7: Degradation curves during ozonation of pyrimidine-2-one in deionized H₂O (a) and in +10%
81 BuOH (b) with parent drug pyrimidine-2-one [M+H]⁺= 97.0396 (black diamonds), and 147.0398 (yellow
82 squares), 111.0165 (blue diamonds), and 230.9814 (green squares) (a,b) and [M+H]⁺= 190.9994 (purple tri-
83 angles) formed in 10% tert.-BuOH (b).

84

85 Table A. 5: Pyrimidine-2(1H)-one ([M+H]⁺= 97.0396) and its observed transformation products (TPs) formed
 86 during ozonation including retention time (*R_t* / min), MS/MS fragmentation patterns, proposed molecular
 87 structures, and mass accuracy ($\delta m/m$ / ppm). TPs without proposed structures were marked as not avail-
 88 able (n.a.), as more investigations should be necessary for clarification. *m/z* values without proposed frag-
 89 ment structures are shown in parentheses.

[M+H] ⁺	<i>R_t</i> / min	proposed structure	MS/MS fragments	$\delta m/m$ / ppm
97.0396	1.975		M ⁺ = 79.0711  [M+H] ⁺ = 61.0350 	0.40
147.0398	1.660		M ⁺ = 58.0773  [M+H] ⁺ = 86.0600  [M+H] ⁺ = 101.0558  [M+H] ⁺ = 71.9750 	1.58

90

[M+H] ⁺	R _t / min	proposed structure	MS/MS fragments	δm/m / ppm
147.0398	1.660		[M+H] ⁺ = 112.9616	1.58
111.0165	1.836	 molecular formula: C ₄ H ₂ N ₂ O ₂	[M+H] ⁺ = 71.9976 (61.0350) M ⁺ = 55.1029  (84.0139)	21.62
190.9994	3.542		(84.9964) (138.9595) (128.9975)	31.01
230.9672	1.859	n.a.	(116.9762) (142.9480) (101.9839)	n.a.

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Table A. 6: Molnupiravir ($[M+H]^+ = 330.1363$) and its observed transformation products (TPs) formed during ozonation including retention time (R_t / min), MS/MS fragmentation patterns, proposed molecular structures, and mass accuracy ($\delta m/m$ / ppm). TPs without proposed structures were marked as not available (n.a.), as more investigations should be necessary for clarification. m/z values without proposed fragment structures are shown in parentheses.

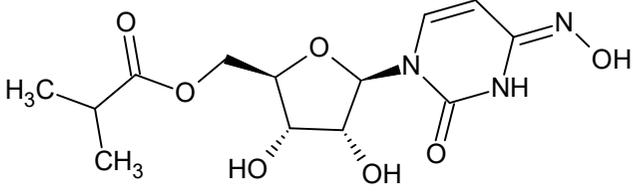
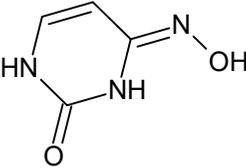
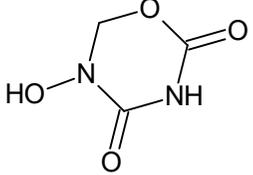
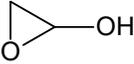
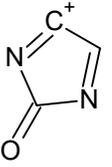
$[M+H]^+$	R_t / min	proposed structure	MS/MS fragments	$\delta m/m$ / ppm
330.1363	8.703			$[M+H]^+ = 128.0545$ 20.29
133.0253	1.829			$[M+H]^+ = 43.0792$ 6.77
				$[M+H]^+ = 61.0427$
				$M^+ = 81.0238$
				

Table A. 6 continued

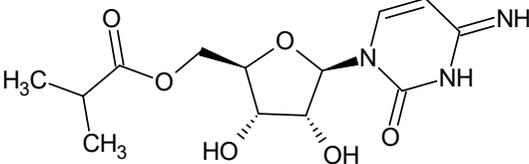
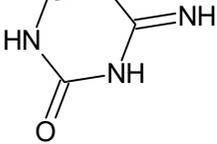
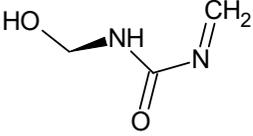
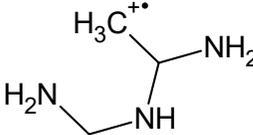
[M+H] ⁺	<i>R</i> _t / min	proposed structure	MS/MS fragments	$\delta m/m$ / ppm
314.1312	7.915		[M+H] ⁺ = 112.0598	11.14
				
			[M+H] ⁺ = 103.0613	
				
			M ⁺ = 89.0996	
				
			(45.0853)	

Table A. 6 continued

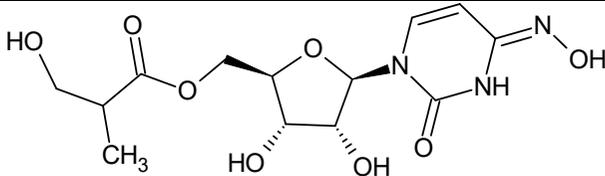
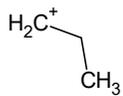
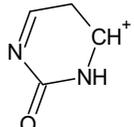
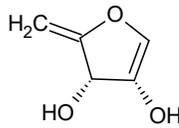
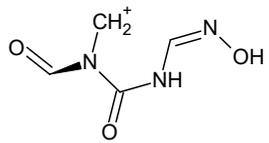
$[M+H]^+$	R_t / min	proposed structure	MS/MS fragments	$\delta m/m$ / ppm
346.1259	7.987		$M^+ = 43.1041$  $M^+ = 97.0586$  $[M+H]^+ = 115.0430$  $M^+ = 144.0588$ 	4.04

Table A. 6 continued

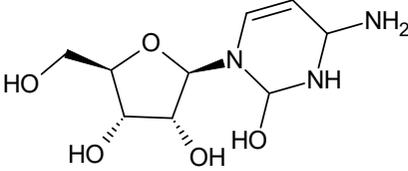
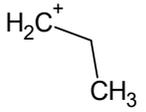
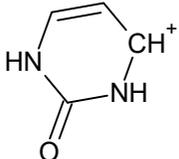
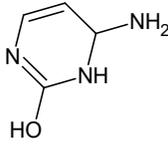
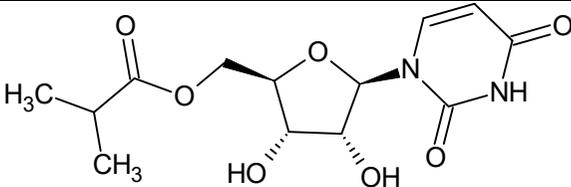
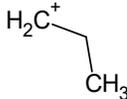
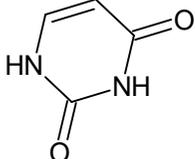
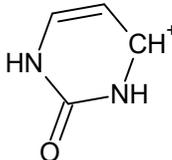
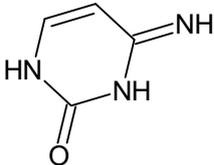
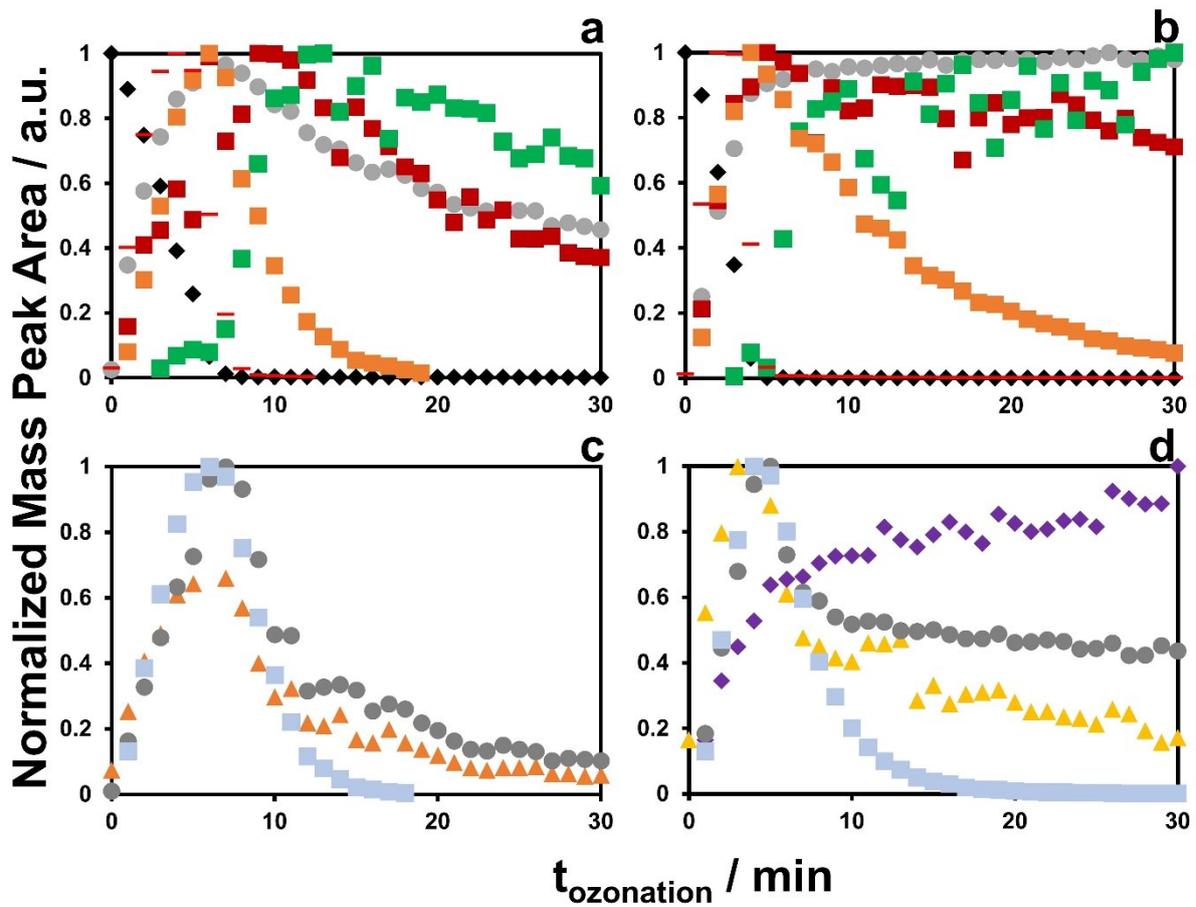
$[M+H]^+$	R_t / min	proposed structure	MS/MS fragments	$\delta m/m$ / ppm
248.1139	8.231		$M^+ = 43.1045$  $M^+ = 97.0591$  $[M+H]^+ = 114.0609$ 	41.11

Table A. 6 continued

$[M+H]^+$	R_t / min	proposed structure	MS/MS fragments	$\delta m/m$ / ppm
315.1204	8.921		$M^+ = 43.1043$  $[M+H]^+ = 113.0422$  $M^+ = 97.0589$ 	5.39

$[M+H]^+$	R_t / min	proposed structure	MS/MS fragments	$\delta m/m$ / ppm
559.2288	9.612	n.a.	(220.1520) (357.1428) (203.1260) (155.0795)	n.a.
626.2354	10.020	n.a.	(424.1295) (222.0968) $[M+H]^+ = 112.0597$	n.a.



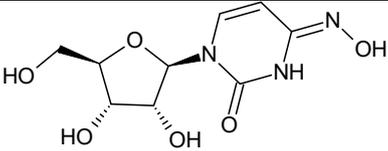
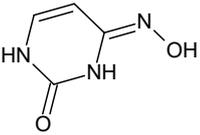
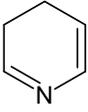
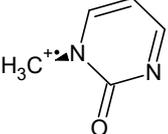
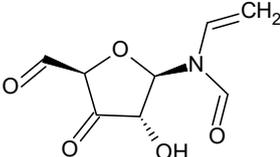
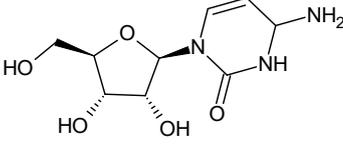
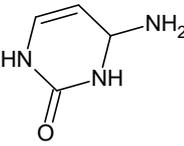
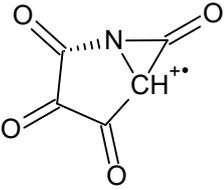


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109 Figure A. 8: Degradation curves during ozonation of EIDD in deionized H₂O (a,c) and in +10% BuOH (b,d)
 110 with parent drug EIDD [M+H]⁺= 260.0903 (black diamonds), and barely degraded TPs [M+H]⁺= 200.0397
 111 (gray circles), 246.0727 (red squares), 243.0453 (green squares), 520.1548 (orange squares) and 486. 1739
 112 (red dashes) (a,b); TPs well degraded in water [M+H]⁺= 244.0789 (orange triangles), 245.0634 (gray circles),
 113 and 471.1383 (light blue squares) (c,d); and final TP [M+H]⁺= 191.0010 only formed in 10% tert.-BuOH.

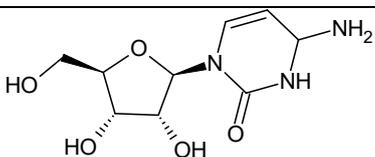
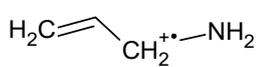
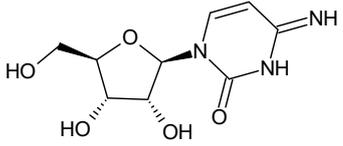
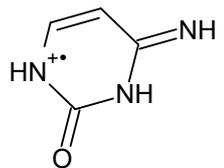
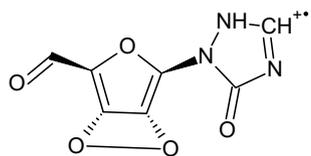
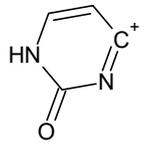
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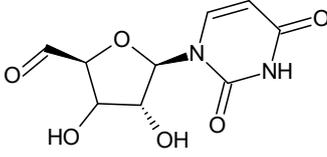
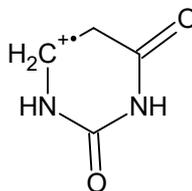
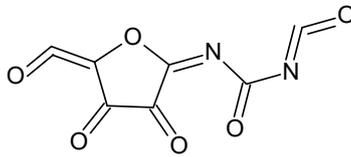
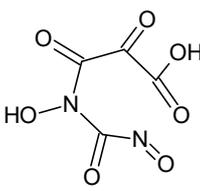
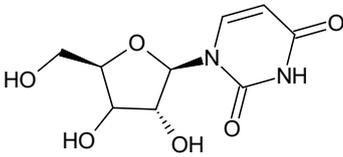
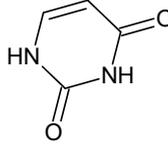
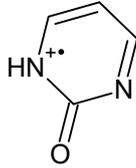
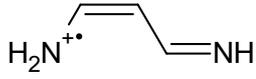
Table A. 7: EIDD-1931 ($[M+H]^+ = 260.0903$) and its observed transformation products (TPs) formed during ozonation including retention time (R_t / min), MS/MS fragmentation patterns, proposed molecular structures, and mass accuracy ($\delta m/m$ / ppm). TPs without proposed structures were marked as not available (n.a.), as more investigations should be necessary for clarification. m/z values without proposed fragment structures are shown in parentheses.

$[M+H]^+$	R_t / min	proposed structure	MS/MS fragments	$\delta m/m$ / ppm
260.0903	3.489		$M^+ = 128.0440$ 	9.96
			$[M+H]^+ = 82.0800$ 	
			$M^{*+} = 110.0461$ 	
200.0537	1.521		(97.9938) (56.9905) (114.9881)	8.00
246.0727	1.755		$[M+H]^+ = 114.0357$ 	145.08
			$M^{*+} = 138.9552$ 	

119

120 Table A. 7 continued

121	[M+H] ⁺	R _t / min	proposed structure	MS/MS fragments	δm/m / ppm
	246.0727	1.755		M ^{*+} = 57.0818 	145.08
	244.0789	2.341		M ^{*+} = 112.0590  M ^{*+} = 208.9900  M ⁺ = 95.0518 	56.94

$[M+H]^+$	R_t / min	proposed structure	MS/MS fragments	$\delta m/m$ / ppm
243.0601	2.590		$M^{*+} = 114.0356$  (190.9808) $[M+H]^+ = 208.9898$ 	4.37
191.0010	3.117		(84.9973) (138.9593) (135.0406)	39.39
245.0776	4.810		$[M+H]^+ = 113.0417$  $M^{*+} = 96.0356$  $M^{*+} = 70.0751$ 	3.21

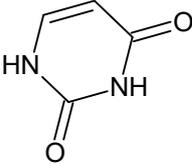
$[M+H]^+$	R_t / min	proposed structure	MS/MS fragments	$\delta m/m$ / ppm
471.1383	6.507	n.a.	(207.0374) (339.0931)	n.a.
520.1548	6.577	n.a.	$[M+H]^+ = 113.0419$	n.a.
			(133.0462) (258.0572)	
486.1492	7.421	n.a.	(222.0481) (354.1082)	n.a.

Table A. 8: Overview of ozonation studies on antiviral pharmaceuticals and related structural motifs.

Study	Compound(s)	Process / matrix	Analytical approach	Structural elucidation / classification	Relevance relative to present work
This work	N ⁴ -hydroxycytosine, cytosine, uracil, pyrimidine-2-one, molnupiravir, EIDD-1931	Ozonation in ultrapure water and 10% tert-BuOH	HPLC-ESI-Q-TOF-HRMS with MS/MS	MS/MS-supported structure proposals; confidence classification according to Schymanski et al. (2014)	First ozonation study of molnupiravir and EIDD-1931; model-compound cascade for mechanistic linkage
Merkus et al., 2024 [1]	Purine, adenine, guanine and purine-based antiviral motifs	Ozonation at controlled pH	HPLC-Orbital Ion Trap-HRMS	HRMS- and MS/MS-based structure proposals	Structural motif-oriented ozonation of purine analogues
Funke et al., 2021 [2]	Zidovudine, thymidine	Ozonation	HPLC-LTQ Orbital Ion Trap-HRMS	MS/MS-based structure proposals	Ozonation of nucleoside Antivirals with pathway discussion
Liu et al., 2021 [3]	Ribavirin	Ozonation and ozonation/PMS under laboratory conditions	UV-HPLC, GC-MS	Oxidation induced transformation products identified by MS	Investigation of ozone and radical contributions

Table A. 8 continued

Study	Compound(s)	Process / matrix	Analytical approach	Structural elucidation / classification	Relevance relative to present work
Zheng et al., 2024 [4]	Oseltamivir	Ozonation of wastewater effluent	UPLC-TOF-MS	Degradation pathway proposed	Application-oriented antiviral ozonation study
Dogrueel et al., 2025 [5]	Favipiravir, oseltamivir	Ozonation and catalytic ozonation	UPLC-MS/MS	Transformation product discussion	Evaluation of antiviral removal and ecotoxicological context
Prasse et al., 2010 [6]	Acyclovir, carboxy-acyclovir	Ozonation in aqueous solution	HPLC-ESI-Q-TOF-HRMS/MS	Oxidation induced transformation products characterized by MS	Antiviral ozonation kinetic and product study
Schlüter-Vorberg et al., 2015 [7]	Acyclovir and related compounds	Ozonation	LC-MS/MS LTQ Orbital Ion Trap-MS	Transformation products identified	Emphasis on transformation-linked toxicity
Fedorova et al., 2016 [8]	Amantadine, oseltamivir carboxylate, zanamivir	Ozonation of wastewater effluent	LC-HRMS	HRMS-based product identification	Antiviral ozonation under effluent conditions

131 **References**

- 132 1. Merkus VI, Leupold MS, Rockel SP, Schmidt TC (2024) Ozonation products of
133 purine derivatives, the basic structures of antiviral micropollutants. *The Science*
134 *of the total environment* 912:169073. 10.1016/j.scitotenv.2023.169073
- 135 2. Funke J, Prasse C, Dietrich C, Ternes TA (2021) Ozonation products of zidovu-
136 dine and thymidine in oxidative water treatment. *Water Research X* 11:100090.
137 10.1016/j.wroa.2021.100090
- 138 3. Liu X, Hong Y, Ding S, Jin W, Dong S, Xiao R, Chu W (2021) Transformation of
139 antiviral ribavirin during ozone/PMS intensified disinfection amid COVID-19 pan-
140 demic. *The Science of the total environment* 790:148030. 10.1016/j.sci-
141 totenv.2021.148030
- 142 4. Zheng M, van Beek SJ, Sánchez-Montes I, Xu B, Gamal El-Din M (2024) Ozona-
143 tion of the antiviral oseltamivir in wastewater effluent: Matrix effect, oxidation
144 pathway, and toxicity assessment. *Journal of Environmental Chemical Engineer-*
145 *ing* 12(6):114297. 10.1016/j.jece.2024.114297
- 146 5. Dogruel S, Chavoshi N, Bilgin-Saritas N, Khataee A, Topuz E, Pehlivanoglu E
147 (2025) Degradation and ecotoxicity of favipiravir and oseltamivir in the presence
148 of microplastics during ozonation and catalytic ozonation of synthetic municipal
149 wastewater effluents. *Journal of Chemical Technology & Biotechnology*
150 100:955–966. 10.1002/jctb.7831
- 151 6. Prasse C, Schlüsener MP, Schulz R, Ternes TA (2010) Antiviral Drugs in
152 Wastewater and Surface Waters: A New Pharmaceutical Class of Environmental
153 Relevance? *Environmental science & technology* 44(5):1728–1735.
154 10.1021/es903216p

- 155 7. Schlüter-Vorberg L, Prasse C, Ternes TA, Mückter H, Coors A (2015) Toxifica-
156 tion by Transformation in Conventional and Advanced Wastewater Treatment:
157 The Antiviral Drug Acyclovir. *Environmental Science & Technology Letters*
158 2(12):342–346. [10.1021/acs.estlett.5b00291](https://doi.org/10.1021/acs.estlett.5b00291)
- 159 8. Fedorova G, Grabic R, Nyhlen J, Järhult JD, Söderström H (2016) Fate of three
160 anti-influenza drugs during ozonation of wastewater effluents - degradation and
161 formation of transformation products. *Chemosphere* 150:723–730.
162 [10.1016/j.chemosphere.2015.12.051](https://doi.org/10.1016/j.chemosphere.2015.12.051)
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