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Supplementary Materials

Aptasensors for the Detection of Environmental Contaminants of High Concern in Water Bodies: A Systematic Review

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Table S1. Studies included through systematic review.

Title	Year	Analyte	Analyte classification	Transductor	LOD	Sensitivity	Water sample type	Test on real samples	Selectivity/ specificity	Reproducibility/ repeatability (%RSD)	Stability	Reusability	Reference
Fabrication of a Novel Photoelectrochemical Aptasensor Using Gold Nanoparticle-Sensitized TiO_2 Film for Quantitative Determination of Diazinon in Solutions	2023	Diazinon	Pesticides	Opto-electrochemical	12.7 ng/L	High	River water	Spiked	Individual	3.1	6% reduction after 2 weeks of storage	NR	[1]
A novel label-free dual-mode aptasensor based on the mutual regulation of silver nanoclusters and	2023	Ampicillin	Pharmaceutical compounds	Optic	0.74 µg/L	Medium	Lake water	Spiked	Individual interferers with the target	3.8	NR	NR	[2]

$MoSe_2$ nanosheets for reliable detection of ampicillin												
Fluorescent nanostructured carbon dot-aptasensor for chlorpyrifos detection: Elucidating the interaction mechanism for an environmentally hazardous pollutant	2023	Chlorpyrifos	Pesticides	Optic	10 ng/L	High	River water	Spiked	Individual interferers with the target	4.2	24% reduction after 8 days of storage	NR	[3]
Molecular simulation-guided aptasensor design of robust and sensitive lateral flow strip for cadmium ion detectionT	2023	Cadmium	Toxic heavy metal	Optic	3.37 mg/L	Medium	River water	Spiked	Individual	1.2	Stability in real samples within 20 min	NR	[4]
Development of an ultrasensitive rGO/AuNPs/ssDNA-based electrochemical aptasensor for detection of Pb^{2+}	2023	Lead	Toxic heavy metal	Electrochemical	0.315 mg/L	Medium	Ponds, lake, and river water	Spiked	Individual and mixed with interferers	NR	NR	NR	[5]
Field-deployable aptasensor with automated analysis of stain patterns for the detection of chlorpyrifos in water	2023	Chlorpyrifos	Pesticides	Optic	70 mg/L	Medium	River water	Spiked	Individual interferers with the target	< 15	Influence of temperature, pH and relative humidity was	NR	[6]

											investigated.		
Construction of a novel fluorescent DNA aptasensor for the fast-response and sensitive detection of copper ions in industrial sewage	2023	Copper	Toxic heavy metal	Optic	19.06 mg/L	Medium	Industrial sewage		Individual	2.6	Incubation for 10 days under the same conditions	NR	[7]
Exploration of the Interaction of Cadmium and Aptamer by Molecular Simulation and Development of Sensitive Capillary Zone Electrophoresis-Based Aptasensor	2023	Cadmium	Toxic heavy metal	Optic	0.562 mg/L	Medium	River water	Spiked	Individual	NR	NR	NR	[8]
A photoelectrochemical aptasensor based on CoN/g-C_3N_4 donor-acceptor configuration for sensitive detection of atrazine	2023	Atrazine	Pesticides	Opto-electrochemical	7.11 ag/L	Ultrahigh	River water	Spiked	Individual	3.27	Response remained stable after 23 cycles for 930 s under light off-on irradiation	NR	[9]
Construction of electrochemiluminescence aptasensor for acetamiprid	2023	Acetamiprid	Pesticides	Opto-electrochemical	0.557 ng/L	High	Pond water	Spiked	Individual	2.5	Reported like	NR	[10]

detection using flower-liked SnO_2 nanocrystals encapsulated Ag_3PO_4 composite as luminophore											reproducibility		
A convenient paper-based fluorescent aptasensor for high-throughput detection of Pb^{2+} in multiple real samples (water-soil-food)	2023	Lead	Toxic heavy metal	Optic	0.123 mg/L	Medium	Lake water	Spiked	Individual and mixed with interferers	5.5	Stored for 40 days at 4 °C	NR	[11]
An interference-free SERS-based aptasensor for chlorpyrifos detection	2023	Chlorpyrifos	Pesticides	Optic	66 ng/L	High	River water	Spiked	Individual	5	Tested for 110 days	NR	[12]
Laser induced graphene electrochemical aptasensor based on tetrahedral DNA for ultrasensitive on-site detection of microcystin-LR	2023	Mycrocystin-LR	Mycotoxin	Electrochemical	2.99 ng/L	High	Pond and river water	Assay in real samples	Individual and mixed with interferers	2	Storage of 7 days at 4 °C	NR	[13]
Internal reference self-powered aptasensor for on-site detection of MC-RR used sunlight as light source and $CoMoS_4$ hollow nanospheres as photocathode	2023	Microcystin-RR	Mycotoxin	Electrochemical	0.33 pg/L	Ultrahigh	Lake water	Spiked	Individual	2.6	Saved at 4 °C for two weeks	NR	[14]
Self-assembled electroactive MOF–magnetic dispersible aptasensor	2023	Mycrocystin-LR	Mycotoxin	Electrochemical	40 ng/L	High	Eutrophic	Assay in real samples	Individual	NR	9.1% signal reduction	Reusability after appropriate	[15]

enables ultrasensitive microcystin-LR detection in eutrophic water							lake water				after 4 weeks at +4 °C	temperature treatments	
Development of Fe-N-C single-atom nanozymes assisted aptasensor for the detection of acetamiprid in water samples	2023	Acetamiprid	Pesticides	Optic	3.76 mg/L	Medium	River water	Spiked	Individual and mixed with interferers	4.46	NR	NR	[16]
A Novel Fluorescent Aptasensor for Arsenic(III) Detection Based on a Triple-Helix Molecular Switch	2023	Arsenic	Toxic heavy metal	Optic	5.24 mg/L	Medium	River water	Spiked	Individual	8	NR	NR	[17]
Self-powered photoelectrochemical aptasensor based on hollow tubular g-C_3N_4/Bi/$BiVO_4$ for tobramycin detection	2023	Tobramycin	Pharmaceutical compounds	Opto-electrochemical	4.27 ng/L	High	River water	Spiked	Individual	4.8	Recording under 10 "on-off" irradiation cycles	NR	[18]
A highly sensitive and selective photoelectrochemical aptasensor for atrazine based on Au NPs/3DOM TiO_2 photonic crystal electrode	2023	Atrazine	Pesticides	Opto-electrochemical	0.167 ng/L	High	River water	Assay in real samples	Individual and mixed with interferers	1.34-7.75	Stable photocurrent after 2000s under visible light illumination	Surface recovery by chemical treatment without destroying the aptamer (85% response recovery)	[19]

In situ synthesis of label-free electrochemical aptasensor-based sandwich-like AuNPs/PPy/Ti_3C_2Tx for ultrasensitive detection of lead ions as hazardous pollutants in environmental fluids	2023	Lead	Toxic heavy metal	Electrochemical	2.07 pg/L	Ultrahigh	River water	Spiked	Individual and mixed with interferers	4.89	7.48% reduction after a week at +4 °C	NR	[20]
Label-free electrochemical aptasensor based on gold nanoparticles/titanium carbide MXene for lead detection with its reduction peak as index signal	2023	Lead	Toxic heavy metal	Electrochemical	62.16 mg/L	Medium	River water	Spiked	Individual	Repeatability: 1.86; reproducibility: 6.25	5.03% reduction after a week at +4 °C	NR	[21]
A novel electrochemical aptasensor based on eco-friendly synthesized titanium dioxide nanosheets and polyethyleneimine grafted reduced graphene oxide for ultrasensitive and selective detection of ciprofloxacin	2023	Ciprofloxacin	Pharmaceutical compounds	Electrochemical	0.232 mg/L	Medium	Lake water	Spiked	Individual	1.2	96.6% after 10 days storage	NR	[22]
On-off-on' electrochemiluminescent aptasensor for Hg2+ based on dual signal amplification enabled by a self-enhanced	2022	Mercury	Toxic heavy metal	Opto-electrochemical	0.601 pg/L	Ultrahigh	River water	Spiked	Individual and mixed with interferers	1.1	Tested after 15 days	NR	[23]

luminophore and resonance energy transfer													
Design of 2D/2D CoAl LDH/g-C_3N_4 heterojunction-driven signal amplification: Fabrication and assay for photoelectrochemical aptasensor of ofloxacin	2022	Oflaxacine	Pharmaceutical compounds	Opto-electrochemical	3.01 fg/L	Ultrahigh	River water	Spiked	Individual	1.7	20 s intervals for continuous 12 cycles	NR	[24]
In situ fabrication of urchin-like Cu@carbon nanoneedles based aptasensor for ultrasensitive recognition of trace mercury ion	2022	Mercury	Toxic heavy metal	Electrochemical	0.742 pg/L	Ultrahigh	Lake water	Spiked	Individual and mixed with interferers	2.3	Tested after 30 days	The reusability was measured through 30 times of hybridization-regeneration reaction	[25]
Direct Z-scheme In_2S_3/Bi_2S_3 heterojunction-based photoelectrochemical aptasensor for detecting oxytetracycline in water	2022	Oxytetracycline	Pharmaceutical compounds	Opto-electrochemical	3.22 ng/L	High	River water	Spiked	Individual	0.97	Excellent irradiation stability after 20 continuous radiation cycles	NR	[26]
A fluorescence aptasensor based on carbon quantum dots and magnetic Fe_3O_4	2022	17β-estradiol	Pharmaceutical compounds	Optic	0.948 ng/L	High	Lake water	Spiked	Individual	4	NR	NR	[27]

nanoparticles for highly sensitive detection of 17 beta-estradiol													
A gold nanoparticle-based visual aptasensor for rapid detection of acetamiprid residues in agricultural products using a smartphone	2022	Acetamiprid	Pesticides	Optic	0.848 mg/L	Low	River water	Spiked	Individual	1.7	NR	NR	[28]
Colorimetric aptasensor for sensitive detection of quinclorac based on exonuclease III-assisted cyclic release of phosphorodiamidate morpholino oligomer mimic enzyme strategy	2022	Quinclorac	Pesticides	Optic	7.019 mg/L	Medium	River water	Spiked	Individual	4	NR	NR	[29]
An enhanced photoelectrochemical ofloxacin aptasensor using NiFe layered double hydroxide/graphitic carbon nitride heterojunction	2021	Oflaxacine	Pharmaceutical compounds	Opto-electrochemical	12.64 pg/L	Ultrahigh	River water	Spiked	Individual	4.6	12 on-off cycles	NR	[30]
A highly selective photoelectrochemical chloramphenicol aptasensor based on AgBr/BiOBr heterojunction	2021	Chloramphenicol	Pharmaceutical compounds	Opto-electrochemical	0.110 mg/L	Medium	River water	Spiked	Individual and Mixed	4.2	7 cycles on/off; repetible	NR	[31]

A highly sensitive and group-targeting aptasensor for total phthalate determination in the environment	2021	Phtalate	Industrial chemicals	Optic	0.591 ng/L	High	River water	Spiked	Individual	21.3	NR	NR	[32]
Reusable, facile, and rapid aptasensor capable of online determination of trace mercury	2021	Mercury	Toxic heavy metal	Optic	0.401 mg/L	Medium	Wastewater	Spiked	Individual	3	NR	110 times of consecutive detection, Tested 31 times in real ww	[33]
A highly sensitive photoelectrochemical aptasensor based on $BiVO_4$ nanoparticles-TiO_2 nanotubes for detection of PCB72	2021	2,3',5,5'-Tetrachlorobiphenyl (PCB 72)	Industrial chemicals	Opto-electrochemical	0.231 ng/L	High	Lake water	Spiked	Individual	5.5	Two week of storage	NR	[34]
Highly sensitive photoelectrochemical aptasensor based on MoS_2 quantum dots/TiO2 nanotubes for detection of atrazine	2021	Atrazine	Pesticides	Opto-electrochemical	0.216 ng/L	High	Agricultural waste water, sewage water and lake water	Spiked	Individual	5.6	The long-term storage investigated (don't say how mane days or minutes was storage)	NR	[35]

An Electrochemical Aptasensor for Pb^{2+} Detection Based on Metal-Organic-Framework-Derived Hybrid Carbon	2021	Lead	Toxic heavy metal	Electrochemical	95.9 ng/L	High	River water	Spiked	Individual	4	NR	NR	[36]
MoS_2/PPy Nanocomposite as a Transducer for Electrochemical Aptasensor of Ampicillin in River Water	2021	Ampicillin	Pharmaceutical compounds	Electrochemical	97.8 pg/L	Ultrahigh	River water	Spiked	Individual	2.2	Two weeks of storage	NR	[37]
Sensitive and selective detection of Hg^{2+} in tap and canal water via self-enhanced ECL aptasensor based on NH2-Ru@SiO_2-NGQDs	2021	Mercury	Toxic heavy metal	Opto-electrochemical	6.02 ng/L	High	Canal water	Spiked	Individual and mixed with interferers	1.1	Tested during 7 days	NR	[38]
Development of a label-free electrochemical aptasensor based on diazonium electrodeposition: Application to cadmium detection in water	2021	Cadmium	Toxic heavy metal	Electrochemical	30.9 ng/L	High	River water	Assay in real samples	Individual	4.5	NR	NR	[39]
Ultra-sensitive electrochemical aptasensor based on zeolitic imidazolate framework-8 derived Ag/Au core-shell nanoparticles for mercury detection in water samples	2021	Mercury	Toxic heavy metal	Electrochemical	3.6 fg/L	Ultrahigh	Wastewater and River water	Spiked	Individual interferers with the target	3.9	Evalated for 18 days	NR	[40]

Ultrasensitive detection of trace Hg^{2+} by SERS aptasensor based on dual recycling amplification in water environment	2021	Mercury	Toxic heavy metal	Optic	22 fg/L	Ultrahigh	Lake water	Spiked	Individual	3.2	NR	NR	[41]
Simultaneous Quantification of Ampicillin and Kanamycin in Water Samples Based on Lateral Flow Aptasensor Strip with an Internal Line	2021	Ampicillin, Kanamycin	Pharmaceutical compounds	Optic	60 pg/L, 15 pg/L	Ultrahigh	Hospital waste water, Chicken farm waste water and Aquaculture waste water	Assay in real samples	Individual	4.8	NR	NR	[42]
A Cationic Surfactant-Decorated Liquid Crystal-Based Aptasensor for Label-Free Detection of Malathion Pesticides in Environmental Samples	2021	Malathion	Pesticides	Optic	0.154 ng/L	High	River water	Spiked	Individual and mixed with interferers	4	NR	NR	[43]
A disposable aptasensor based on a gold-plated coplanar electrode array for	2021	Copper	Toxic heavy metal	Electrochemical	0.189 pg/L	Ultrahigh	Lake water	Spiked	Individual	8	6 days storage	NR	[44]

on-site and real-time determination of Cu^{2+}													
A label-free enrofloxacin electrochemical aptasensor constructed by a semiconducting CoNi-based metal-organic framework (MOF)	2021	Enrofloxacina	Pharmaceutical compounds	Electrochemical	0.22 pg/L	Ultrahigh	River water	Spiked	Individual and mixed with interferers	0.4	Tested for 15 days	NR	[45]
An electrochemiluminescence aptasensor for diethylstilbestrol assay based on resonance energy transfer between Ag_3PO_4-Cu-MOF(ii) and silver nanoparticles	2021	Diethylstilbestrol	Pharmaceutical compounds	Opto-electrochemical	0.19 mg/L	Medium	Fishpond water	Spiked	Individual and mixed with interferers	3.2	Continuous scanning for 11 cycles	NR	[46]
An Ultrasensitive Label-Free Fluorescent Aptasensor Platform for Detection of Sulfamethazine	2021	Sulfamethazine	Pharmaceutical compounds	Optic	0.821 mg/L	Medium	Lake water	Spiked	Individual	4.4	NR	NR	[47]
Graphene oxide-regulated low-background aptasensor for the turn on detection of tetracycline	2021	Tetracycline	Pharmaceutical compounds	Optic	6.2 ng/L	High	Wastewater	Spiked	Individual and mixed with interferers	4.8	NR	NR	[48]
B, N co-doped graphene synergistic catalyzed ZnO quantum dots with amplified cathodic electrochemiluminescence for	2021	Microcystin-LR	Mycotoxin	Electrochemical	29.86 pg/L	Ultrahigh	Lake water	Spiked	Individual	4.7	Stability for two weeks	NR	[49]

fabricating microcystin-LR aptasensor													
Catalysis-induced performance enhancement of an electrochemical microcystin-LR aptasensor based on cobalt-based oxide on a B, N co-doped graphene hydrogel	2021	Microcystin-LR	Mycotoxin	electrochemical	29.86 pg/L	Ultrahigh	Lake water	Spiked	Individual	8.7	T10 days satbility	NR	[50]
Colorimetric aptasensor for sensitive detection of kanamycin based on target-triggered catalytic hairpin assembly amplification and DNA-gold nanoparticle probes	2021	Kanamycin	Pharmaceutical compounds	Optic	4.8 ng/L	High	River water	Spiked	Individual and mixed with interferers	3	NR	NR	[51]
A dichromatic label-free aptasensor for sulfadimethoxine detection in fish and water based on AuNPs color and fluorescent dyeing of double-stranded DNA with SYBR Green I	2020	Sulfadimethoxine	Pharmaceutical compounds	Optic	3.4 mg/L	Medium	Pond water	Spiked	Individual interferers with the target	7	NR	NR	[52]
Co_3O_4 nanoparticles/graphitic carbon nitride heterojunction for	2020	Oxytetracycline	Pharmaceutical compounds	Opto-electrochemical	1.6 ng/L	High	River water	Spiked	Individual	3.3	500 s light on-off	NR	[53]

photoelectrochemical aptasensor of oxytetracycline													
An ultrasensitive electrochemiluminescence aptasensor for the detection of diethylstilbestrol based on the enhancing mechanism of the metal-organic framework NH_2-MIL-125(Ti) in a 3,4,9,10-perylenetetracarboxylic acid/$K_2S_2O_8$ system	2020	Diethylstilbestrol	Pharmaceutical compounds	Opto-electrochemical	75 fg/L	Ultrahigh	Pond water, tape water and lake water	Spiked	Individual and mixed with interferers	2	20 cycles of successive potential scans	NR	[54]
A low-cost paper-based aptasensor for simultaneous trace-level monitoring of mercury (II) and silver (I) ions	2020	Mercury and Silver	Toxic heavy metal	Optic	0.267 ng/L, 0.109 ng/L	High	Lake water	Spiked	Individual interferers with the target	0.1	NR	NR	[55]
Ultrasensitive colorimetric aptasensor for Hg^{2+} detection using Exo-III assisted target recycling amplification and unmodified AuNPs as indicators	2020	Mercury	Toxic heavy metal	Optic	40 ng/L	High	Lake water	Assay in real samples	Individual and mixed with interferers	0.4	NR	NR	[56]
Electrochemical aptasensor for ultrasensitive detection of PCB77 using	2020	3,3′,4,4′-Tetrachlorobiphenyl (PCB 77)	Industrial chemicals	Electrochemical	80 fg/L	Ultrahigh	River water	Spiked	Individual	4.2	Tested after 30 days	NR	[57]

thionine-functionalized MoS_2-rGO nanohybrid													
Ultrasensitive detection of amoxicillin by TiO_2-g-C_3N_4@AuNPs impedimetric aptasensor: Fabrication, optimization, and mechanism	2020	Amoxicillin	Pharmaceutical compounds	Electrochemical	73 ng/L	High	Wastewater	Assay in real samples	Individual interferers with the target	2	Tested for 20 days	NR	[58]
Ultrasensitive detection of bisphenol A under diverse environments with an electrochemical aptasensor based on multicomponent AgMo heteronanostructure	2020	Bisphenol A	Industrial chemicals	Electrochemical	0.199 pg/L	Ultrahigh	River water	Spiked	Individual and mixed with interferers	4.4	Tested for 15 days	Regenerated and repeated by 7 cycles of regeneration	[59]
A photoelectrochemical aptasensor for the determination of bisphenol A based on the Cu (I) modified graphitic carbon nitride	2020	Bisphenol A	Industrial chemicals	Electrochemical	15 pg/L	Ultrahigh	Wastewater	Spiked	Individual	3.1	Tested for 20 days	NR	[60]
A Sensitive Impedimetric Aptasensor Based on Carbon Nanodots Modified Electrode for Detection of 17ss-Estradiol	2020	Estradiol	Pharmaceutical compounds	Electrochemical	0.136 ng/L	High	River water	Spiked	Individual and mixed with interferers	1.3	Stability after 30 days	NR	[61]

A novel SWCNT-amplified signal-on electrochemical aptasensor for the determination of trace level of bisphenol A in human serum and lake water	2020	Bisphenol A	Industrial chemicals	Electrochemical	18 ag/L	Ultrahigh	Lake water	Spiked	Individual interferers with the target	2.1	Tested during 17 days	Cannot be re-used for detection	[62]
Electrochemical surface plasmon resonance (EC-SPR) aptasensor for ampicillin detection	2019	Ampicillin	Pharmaceutical compounds	Optic	0.35 mg/L	Low	River water	Spiked	Individual interferers with the target	4.5	NR	NR	[63]
Label-Free Fluorescence-Based Aptasensor for the Detection of Sulfadimethoxine in Water and Fish	2019	Sulfadimethoxine	Pharmaceutical compounds	Optic	1.5 mg/L	Medium	Lake water	Spiked	Individual	2.5-6.0 (wáter simples); 3.3-6.7 (fish samples)	NR	NR	[64]
Label-free and highly selective electrochemical aptasensor for detection of PCBs based on nickel hexacyanoferrate nanoparticles/reduced graphene oxides hybrids	2019	3,3′,4,4′-Tetrachlorobiphenyl (PCB 77)	Industrial chemicals	Electrochemical	0.22 ng/L	High	Lake water	Spiked	Individual	5	Storage for two weeks	5 lectures same assay	[65]
Design of a simple and novel photoelectrochemical aptasensor for detection of 3,3 ',4,4 '-tetrachlorobiphenyl	2019	3,3′,4,4′-Tetrachlorobiphenyl (PCB 77)	Industrial chemicals	Opto-electrochemical	99.86 pg/L	Ultrahigh	Domestic sewage water	Spiked	Individual	6.1	Tested 20 minutes and after two weeks of storage	NR	[66]

Novel nanoarchitecture of Co-MOF-on-TPN-COF hybrid: Ultralowly sensitive bioplatform of electrochemical aptasensor toward ampicillin	2019	Ampicillin	Pharmaceutical compounds	Electrochemical	0.216 pg/L	Ultrahigh	River water	Spiked	Individual	3.3	Tested for 15 days, 8 cycles	NR	[67]
Multicolor Aptasensor Based on DNA-Induced Au-Ag Nanorods for Simultaneous and Visual Detection of Inorganic and Organic Mercury	2019	Mercury Methyl-mercury Ethyl-mercury	Toxic heavy metal	Optic	2 mg/L, 9.9 mg/L, 10 mg/L	Low	Seawater	Spiked	Individual	NR	NR	NR	[68]
Fluorometric aptasensor for cadmium(II) by using an aptamer-imprinted polymer as the recognition element	2019	Cadmium	Toxic heavy metal	Optic	0.135 ng/L	High	Irrigation water, industrial water	Assay in real samples	Individual	9.9	Tested 1 month of storage	NR	[69]
Fluorometric label-free aptasensor for detection of the pesticideacetamiprid by using cationic carbon dots prepared with cetrimonium bromide	2019	Acetamiprid	Pesticides	Optic	66.8 ng/L	High	Wastewater	Spiked	Individual	3.5	NR	NR	[70]
Reusable chemiluminescent fiber optic aptasensor for the determination	2019	17β-estradiol	Pharmaceutical compounds	Optic	49.02 ng/L	High	Wastewater	Spiked	Individual	9.2	NR	Could be reused at least 150 times	[71]

of 17 beta-estradiol in water samples													
A SWCNT based aptasensor system for antibiotic oxytetracycline detection in water samples	2019	Oxytetracycline	Pharmaceutical compounds	Electrochemical	1.15 mg/L	Medium	Wastewater	Spiked	Individual	8	Tested after 30 days	Could be reused at 5 times	[72]
Construction of Ce-MOF@COF hybrid nanostructure: Label-free aptasensor for the ultrasensitive detection of oxytetracycline residues in aqueous solution environments	2019	Oxytetracycline	Pharmaceutical compounds	Electrochemical	17.4 pg/L	Ultrahigh	River water	Spiked	Individual and mixed with interferers	5	Stability after 15 days	NR	[73]

Table S2. SELEX variants and purposes employing different technologies.

Technique	Purpose	Technology	Result	Limitation	Reference
Negative SELEX	Avoid false negatives	Incubate the library with purification support agarose for better separation of bound and unbound sequences	A 10-fold increase in aptamer affinity	NR [1]	[74]
Counter SELEX	Avoid false negatives	It relies on the same technology of negative-SELEX and additionally uses structurally similar targets to incubate with aptamers to effectively discriminate non-specific oligonucleotides	Obtaining more specific aptamers	NR [1]	[75]
Capillary Electrophoresis SELEX (CE-SELEX)	Separates target delimited sequences from unlinked sequences	Difference in electrophoretic mobility	Allows selection of aptamer candidates with high affinity, while reducing selection	NR [1]	[76,77]

			rounds to 1-4 out of nearly 20 in conventional SELEX		
Non-SELEX	Select aptamers without amplification	Non-Equilibrium Capillary Electrophoresis of Equilibrium Mixtures (NECEEM), which cleaves the oligonucleotide-target complex from the free oligonucleotides	Shortens sorting time to one hour as opposed to several weeks or months required for a conventional SELEX	The volume of the library injected into the capillary limits the number of sequences (~10^{12} sequences)	[78]
Micro Free Flow Electrophoresis (μFFE)	Overcoming the limited size of the library used in non-SELEX	Use of highly specialized equipment for electrophoresis	Library can reach up to ~10^{14}, a 300x improvement in library size over CE-SELEX	Need to manufacture special μFFE equipment	[79]
Microfluidic SELEX (M-SELEX)	Develop a simple apparatus that is relatively inexpensive to assemble and perform automatic selection of aptamers	Combine the traditional SELEX with a microfluidic system. The prototype contains reagent-loaded microlines, a pressurized reagent reservoir manifold, a PCR thermal cycler, and actuatable valves for sample selection and routing.	NR [1]	It could generate aggregates, thus causing low aptamer purity and recovery	[80,81]
Cell SELEX	Create aptamers capable of binding to proteins at the endogenous level or under cellular conditions	Use the entire living cell as the target	Direct use for diagnostic and therapeutic applications	Degradation of aptamers by in vivo conditions	[82]
In vivo SELEX	Generate tissue-penetrating aptamers directly on models	Inject a set of aptamers into the target tissue or animal and subsequently extract the aptamers, amplify them, and reinject them into another animal or target tissue	Generate aptamers using live animal models as targets or selection conditions	Degradation of aptamers by in vivo conditions	[83]
High-Throughput Sequencing SELEX	Generate a method for the individual identification of the sequences and selection of the best aptamers	Sequence the library in all rounds of selection. Therefore, the enriched sequences are visible at an earlier round	It enables global analysis of large sequence data sets and facilitates comprehensive characterization of aptamers, binding affinity and/or specificity, structure prediction, abundance quantification,	A high cost of operation	[84]

			and aptamer-target interactions		
FluMag-SELEX	Improve the quantification of aptamers as well as their purification	Fluorescent labeling of DNA with magnetic separation technology	Manual processing of multiple targets without the need for expensive robotics, and a selection procedure that is universal and adaptable to different types of targets	Inefficient for small molecules	[85]
Capture-SELEX	Generation of aptamers for small molecules	Immobilization of a biotinylated hybridized library on a solid support	Generate aptamers against small molecule contaminants	A false positive can occur in the Capture-SELEX immobilization process	[86]

[1] Not reported.

References

1. Deiminiat, B.; Rounaghi, G.H. Fabrication of a Novel Photoelectrochemical Aptasensor Using Gold Nanoparticle-Sensitized TiO2 Film for Quantitative Determination of Diazinon in Solutions. *Electrocatalysis* **2023**, *14*, 484–498, doi:10.1007/s12678-023-00813-2.
2. Fan, P.; Qian, X.; Li, Q.; Jiang, P.; Wu, Q.; Huang, G.; Zhang, Z.; Li, L. A Novel Label-Free Dual-Mode Aptasensor Based on the Mutual Regulation of Silver Nanoclusters and MoSe2 Nanosheets for Reliable Detection of Ampicillin. *Anal Chim Acta* **2023**, *1251*, 340997, doi:https://doi.org/10.1016/j.aca.2023.340997.
3. Gaviria-Arroyave, M.I.; Arango, J.P.; Barrientos Urdinola, K.; Cano, J.B.; Peñuela Mesa, G.A. Fluorescent Nanostructured Carbon Dot-Aptasensor for Chlorpyrifos Detection: Elucidating the Interaction Mechanism for an Environmentally Hazardous Pollutant. *Anal Chim Acta* **2023**, *1278*, 341711, doi:https://doi.org/10.1016/j.aca.2023.341711.
4. Irfan, M.; Murtaza, G.; Fu, S.; Chen, A.; Qu, F.; Su, X. Molecular Simulation-Guided Aptasensor Design of Robust and Sensitive Lateral Flow Strip for Cadmium Ion Detection. *Analyst* **2023**, *148*, 1961–1969, doi:10.1039/D3AN00202K.
5. Kushwah, M.; Yadav, R.; Berlina, A.N.; Gaur, K.; Gaur, M.S. Development of an Ultrasensitive RGO/AuNPs/SsDNA-Based Electrochemical Aptasensor for Detection of Pb2+. *Journal of Solid State Electrochemistry* **2023**, *27*, 559–574, doi:10.1007/s10008-022-05344-2.
6. Macagno, J.; Gerlero, G.S.; Satuf, M.L.; Berli, C.L.A. Field-Deployable Aptasensor with Automated Analysis of Stain Patterns for the Detection of Chlorpyrifos in Water. *Talanta* **2023**, *252*, 123782, doi:https://doi.org/10.1016/j.talanta.2022.123782.
7. Mou, Y.; Zhang, Y.; Lin, X.; Chen, M.; Xia, Y.; Zhu, S.; Wei, C.; Luo, X. Construction of a Novel Fluorescent DNA Aptasensor for the Fast-Response and Sensitive Detection of Copper Ions in Industrial Sewage. *Analytical Methods* **2023**, *15*, 3466–3475, doi:10.1039/D3AY00699A.

8. Muhammad, I.; Murtaza, G.; Zhao, Y.; Rizvi, A.S.; Fu, S.; Su, X.; Qu, F. Exploration of the Interaction of Cadmium and Aptamer by Molecular Simulation and Development of Sensitive Capillary Zone Electrophoresis-Based Aptasensor. *J Chem Inf Model* **2023**, *63*, 2783–2793, doi:10.1021/acs.jcim.3c00162.
9. Qi, Z.; Yan, P.; Qian, J.; Zhu, L.; Li, H.; Xu, L. A Photoelectrochemical Aptasensor Based on CoN/g-C3N4 Donor-Acceptor Configuration for Sensitive Detection of Atrazine. *Sens Actuators B Chem* **2023**, *387*, 133792, doi:https://doi.org/10.1016/j.snb.2023.133792.
10. Su, C.; Dong, C.; Jiang, D.; Shan, X.; Chen, Z. Construction of Electrochemiluminescence Aptasensor for Acetamiprid Detection Using Flower-Liked SnO2 Nanocrystals Encapsulated Ag3PO4 Composite as Luminophore. *Microchemical Journal* **2023**, *187*, 108374, doi:https://doi.org/10.1016/j.microc.2022.108374.
11. Suo, Z.; Liang, R.; Liu, R.; Wei, M.; He, B.; Jiang, L.; Sun, X.; Jin, H. A Convenient Paper-Based Fluorescent Aptasensor for High-Throughput Detection of Pb2+ in Multiple Real Samples (Water-Soil-Food). *Anal Chim Acta* **2023**, *1239*, 340714, doi:https://doi.org/10.1016/j.aca.2022.340714.
12. Wang, H.; Chen, Z.; Zhu, C.; Du, H.; Mao, J.; Qin, H.; She, Y.; Yan, M. An Interference-Free SERS-Based Aptasensor for Chlorpyrifos Detection. *Anal Chim Acta* **2023**, *1268*, 341398, doi:https://doi.org/10.1016/j.aca.2023.341398.
13. Wang, Y.; Li, Y.; Liu, C.; Dong, N.; Liu, D.; You, T. Laser Induced Graphene Electrochemical Aptasensor Based on Tetrahedral DNA for Ultrasensitive On-Site Detection of Microcystin-LR. *Biosens Bioelectron* **2023**, *239*, 115610, doi:https://doi.org/10.1016/j.bios.2023.115610.
14. Wei, J.; Ding, J.; Hu, Q.; Tian, X.; Bai, M.; Qian, J.; Wang, K. Internal Reference Self-Powered Aptasensor for on-Site Detection of MC-RR Used Sunlight as Light Source and CoMoS4 Hollow Nanospheres as Photocathode. *Anal Chim Acta* **2023**, *1262*, 341239, doi:https://doi.org/10.1016/j.aca.2023.341239.
15. Wei, T.; Zhang, Y.; Wang, H.; Li, H.; Fang, T.; Wang, Z.; Dai, Z. Self-Assembled Electroactive MOF–Magnetic Dispersible Aptasensor Enables Ultrasensitive Microcystin-LR Detection in Eutrophic Water. *Chemical Engineering Journal* **2023**, *466*, 142809, doi:https://doi.org/10.1016/j.cej.2023.142809.
16. Yu, H.; Wang, C.; Xiong, X.; Dai, B.; Wang, Y.; Feng, Z.; luo, H.; Zhu, J.; Shen, G.; Deng, Y.; et al. Development of Fe-N-C Single-Atom Nanozymes Assisted Aptasensor for the Detection of Acetamiprid in Water Samples. *Microchemical Journal* **2023**, *193*, 109174, doi:https://doi.org/10.1016/j.microc.2023.109174.
17. Yuan, M.; Yang, Y.; Chau, N.T.Q.; Zhang, Q.; Wu, X.; Chen, J.; Wu, Z.; Zhong, H.; Li, Y.; Xu, F. A Novel Fluorescent Aptasensor for Arsenic(III) Detection Based on a Triple-Helix Molecular Switch. *Molecules* **2023**, *28*, 2341, doi:10.3390/molecules28052341.
18. Zhang, Y.; Zhu, Y.; Zeng, T.; Qiao, L.; Zhang, M.; Song, K.; Yin, N.; Tao, Y.; Zhao, Y.; Zhang, C.; et al. Self-Powered Photoelectrochemical Aptasensor Based on Hollow Tubular g-C3N4/Bi/BiVO4 for Tobramycin Detection. *Anal Chim Acta* **2023**, *1250*, 340951, doi:https://doi.org/10.1016/j.aca.2023.340951.
19. Zhang, Z.; Ding, X.; Lu, G.; Du, B.; Liu, M. A Highly Sensitive and Selective Photoelectrochemical Aptasensor for Atrazine Based on Au NPs/3DOM TiO2 Photonic Crystal Electrode. *J Hazard Mater* **2023**, *451*, 131132, doi:https://doi.org/10.1016/j.jhazmat.2023.131132.
20. Zhang, Z.; Karimi-Maleh, H. In Situ Synthesis of Label-Free Electrochemical Aptasensor-Based Sandwich-like AuNPs/PPy/Ti3C2Tx for Ultrasensitive Detection of Lead Ions as Hazardous Pollutants in Environmental Fluids. *Chemosphere* **2023**, *324*, 138302, doi:https://doi.org/10.1016/j.chemosphere.2023.138302.
21. Zhang, Z.; Karimi-Maleh, H. Label-Free Electrochemical Aptasensor Based on Gold Nanoparticles/Titanium Carbide MXene for Lead Detection with Its Reduction Peak as Index Signal. *Adv Compos Hybrid Mater* **2023**, *6*, 68, doi:10.1007/s42114-023-00652-1.

22. Zhu, Y.; Li, X.; Wu, M.; Shi, M.; Tian, Q.; Fu, L.; Tsai, H.-S.; Xie, W.-F.; Lai, G.; Wang, G.; et al. A Novel Electrochemical Aptasensor Based on Eco-Friendly Synthesized Titanium Dioxide Nanosheets and Polyethyleneimine Grafted Reduced Graphene Oxide for Ultrasensitive and Selective Detection of Ciprofloxacin. *Anal Chim Acta* **2023**, *1275*, 341607, doi:https://doi.org/10.1016/j.aca.2023.341607.
23. Li, L.; Chen, B.; Liu, X.; Jiang, P.; Luo, L.; Li, X.; You, T. 'On-off-on' Electrochemiluminescent Aptasensor for Hg2+ Based on Dual Signal Amplification Enabled by a Self-Enhanced Luminophore and Resonance Energy Transfer. *Journal of Electroanalytical Chemistry* **2022**, *907*, 116063, doi:https://doi.org/10.1016/j.jelechem.2022.116063.
24. Chen, Y.; Xu, L.; Yang, M.; Jia, Y.; Yan, Y.; Qian, J.; Chen, F.; Li, H. Design of 2D/2D CoAl LDH/g-C3N4 Heterojunction-Driven Signal Amplification: Fabrication and Assay for Photoelectrochemical Aptasensor of Ofloxacin. *Sens Actuators B Chem* **2022**, *353*, 131187, doi:https://doi.org/10.1016/j.snb.2021.131187.
25. Liu, T.; Lin, B.; Yuan, X.; Chu, Z.; Jin, W. In Situ Fabrication of Urchin-like Cu@carbon Nanoneedles Based Aptasensor for Ultrasensitive Recognition of Trace Mercury Ion. *Biosens Bioelectron* **2022**, *206*, 114147, doi:https://doi.org/10.1016/j.bios.2022.114147.
26. Sun, Z.; Zhao, L.; Li, C.; Jiang, Y.; Wang, F. Direct Z-Scheme In2S3/Bi2S3 Heterojunction-Based Photoelectrochemical Aptasensor for Detecting Oxytetracycline in Water. *J Environ Chem Eng* **2022**, *10*, 107404, doi:https://doi.org/10.1016/j.jece.2022.107404.
27. Wei, Q.; Zhang, P.; Pu, H.; Sun, D.-W. A Fluorescence Aptasensor Based on Carbon Quantum Dots and Magnetic Fe3O4 Nanoparticles for Highly Sensitive Detection of 17β-Estradiol. *Food Chem* **2022**, *373*, 131591, doi:https://doi.org/10.1016/j.foodchem.2021.131591.
28. Xu, C.; Lin, M.; Song, C.; Chen, D.; Bian, C. A Gold Nanoparticle-Based Visual Aptasensor for Rapid Detection of Acetamiprid Residues in Agricultural Products Using a Smartphone. *RSC Adv* **2022**, *12*, 5540–5545, doi:10.1039/D2RA00348A.
29. Yang, L.; Ye, X.; Li, X.; Huang, Z.; Chen, F.; Yang, W.; Wang, Z. Colorimetric Aptasensor for Sensitive Detection of Quinclorac Based on Exonuclease III-Assisted Cyclic Release of Phosphorodiamidate Morpholino Oligomer Mimic Enzyme Strategy. *Anal Chim Acta* **2022**, *1207*, 339815, doi:https://doi.org/10.1016/j.aca.2022.339815.
30. Chen, Y.; Xu, L.; Dong, J.; Yan, P.; Chen, F.; Qian, J.; Li, H. An Enhanced Photoelectrochemical Ofloxacin Aptasensor Using NiFe Layered Double Hydroxide/Graphitic Carbon Nitride Heterojunction. *Electrochim Acta* **2021**, *368*, 137595, doi:https://doi.org/10.1016/j.electacta.2020.137595.
31. Chen, Y.; Yan, P.; Lu, G.; Chen, J.; Chen, F.; Xu, L. A Highly Selective Photoelectrochemical Chloramphenicol Aptasensor Based on AgBr/BiOBr Heterojunction. *Inorg Chem Commun* **2021**, *123*, 108333, doi:https://doi.org/10.1016/j.inoche.2020.108333.
32. Chen, Y.; Wang, Z.; Liu, S.; Zhao, G. A Highly Sensitive and Group-Targeting Aptasensor for Total Phthalate Determination in the Environment. *J Hazard Mater* **2021**, *412*, 125174, doi:https://doi.org/10.1016/j.jhazmat.2021.125174.
33. Chen, Y.; Zhu, Q.; Zhou, X.; Wang, R.; Yang, Z. Reusable, Facile, and Rapid Aptasensor Capable of Online Determination of Trace Mercury. *Environ Int* **2021**, *146*, 106181, doi:https://doi.org/10.1016/j.envint.2020.106181.

34. Fan, L.; Liang, G.; Yan, W.; Guo, Y.; Bi, Y.; Dong, C. A Highly Sensitive Photoelectrochemical Aptasensor Based on BiVO4 Nanoparticles-TiO2 Nanotubes for Detection of PCB72. *Talanta* **2021**, *233*, 122551, doi:https://doi.org/10.1016/j.talanta.2021.122551.
35. Fan, L.; Zhang, C.; Liang, G.; Yan, W.; Guo, Y.; Bi, Y.; Dong, C. Highly Sensitive Photoelectrochemical Aptasensor Based on MoS2 Quantum Dots/TiO2 Nanotubes for Detection of Atrazine. *Sens Actuators B Chem* **2021**, *334*, 129652, doi:https://doi.org/10.1016/j.snb.2021.129652.
36. Ding, J.; Zhang, D.; Liu, Y.; Zhan, X.; Lu, Y.; Zhou, P.; Zhang, D. An Electrochemical Aptasensor for Pb2+ Detection Based on Metal–Organic-Framework-Derived Hybrid Carbon. *Biosensors (Basel)* **2020**, *11*, 1, doi:10.3390/bios11010001.
37. Hamami, M.; Bouaziz, M.; Raouafi, N.; Bendounan, A.; Korri-Youssoufi, H. MoS2/PPy Nanocomposite as a Transducer for Electrochemical Aptasensor of Ampicillin in River Water. *Biosensors (Basel)* **2021**, *11*, 311, doi:10.3390/bios11090311.
38. Li, L.; Chen, B.; Luo, L.; Liu, X.; Bi, X.; You, T. Sensitive and Selective Detection of Hg2+ in Tap and Canal Water via Self-Enhanced ECL Aptasensor Based on NH2–Ru@SiO2-NGQDs. *Talanta* **2021**, *222*, 121579, doi:https://doi.org/10.1016/j.talanta.2020.121579.
39. Rabai, S.; Benounis, M.; Catanante, G.; Baraket, A.; Errachid, A.; Jaffrezic Renault, N.; Marty, J.-L.; Rhouati, A. Development of a Label-Free Electrochemical Aptasensor Based on Diazonium Electrodeposition: Application to Cadmium Detection in Water. *Anal Biochem* **2021**, *612*, 113956, doi:https://doi.org/10.1016/j.ab.2020.113956.
40. Salandari-Jolge, N.; Ensafi, A.A.; Rezaei, B. Ultra-Sensitive Electrochemical Aptasensor Based on Zeolitic Imidazolate Framework-8 Derived Ag/Au Core-Shell Nanoparticles for Mercury Detection in Water Samples. *Sens Actuators B Chem* **2021**, *331*, 129426, doi:https://doi.org/10.1016/j.snb.2020.129426.
41. Tian, C.; Zhao, L.; Zhu, J.; Zhang, S. Ultrasensitive Detection of Trace Hg2+ by SERS Aptasensor Based on Dual Recycling Amplification in Water Environment. *J Hazard Mater* **2021**, *416*, 126251, doi:https://doi.org/10.1016/j.jhazmat.2021.126251.
42. Lin, J.; Shi, A.; Zheng, Z.; Huang, L.; Wang, Y.; Lin, H.; Lin, X. Simultaneous Quantification of Ampicillin and Kanamycin in Water Samples Based on Lateral Flow Aptasensor Strip with an Internal Line. *Molecules* **2021**, *26*, 3806, doi:10.3390/molecules26133806.
43. Nguyen, D.K.; Jang, C.-H. A Cationic Surfactant-Decorated Liquid Crystal-Based Aptasensor for Label-Free Detection of Malathion Pesticides in Environmental Samples. *Biosensors (Basel)* **2021**, *11*, 92, doi:10.3390/bios11030092.
44. Qi, H.; Huang, X.; Wu, J.; Zhang, J.; Wang, F.; Qu, H.; Zheng, L. A Disposable Aptasensor Based on a Gold-Plated Coplanar Electrode Array for on-Site and Real-Time Determination of Cu2+. *Anal Chim Acta* **2021**, *1183*, 338991, doi:https://doi.org/10.1016/j.aca.2021.338991.
45. Song, Y.; Xu, M.; Liu, X.; Li, Z.; Wang, C.; Jia, Q.; Zhang, Z.; Du, M. A Label-Free Enrofloxacin Electrochemical Aptasensor Constructed by a Semiconducting CoNi-Based Metal–Organic Framework (MOF). *Electrochim Acta* **2021**, *368*, 137609, doi:https://doi.org/10.1016/j.electacta.2020.137609.
46. Su, C.; Song, Q.; Jiang, D.; Dong, C.; Shan, X.; Chen, Z. An Electrochemiluminescence Aptasensor for Diethylstilbestrol Assay Based on Resonance Energy Transfer between Ag3PO4-Cu-MOF(Ii) and Silver Nanoparticles. *Analyst* **2021**, *146*, 4254–4260, doi:10.1039/D1AN00599E.

47. Wang, Y.; Yan, X.; Kou, Q.; Sun, Q.; Wang, Y.; Wu, P.; Yang, L.; Tang, J.; Le, T. An Ultrasensitive Label-Free Fluorescent Aptasensor Platform for Detection of Sulfamethazine. *Int J Nanomedicine* **2021**, *Volume 16*, 2751–2759, doi:10.2147/IJN.S307080.
48. Xu, J.; Qing, T.; Jiang, Z.; Zhang, P.; Feng, B. Graphene Oxide-Regulated Low-Background Aptasensor for the "Turn on" Detection of Tetracycline. *Spectrochim Acta A Mol Biomol Spectrosc* **2021**, *260*, 119898, doi:https://doi.org/10.1016/j.saa.2021.119898.
49. Yuan, R.; Ding, L.; You, F.; Wen, Z.; Liu, Q.; Wang, K. B, N Co-Doped Graphene Synergistic Catalyzed ZnO Quantum Dots with Amplified Cathodic Electrochemiluminescence for Fabricating Microcystin-LR Aptasensor. *Sens Actuators B Chem* **2021**, *349*, 130795, doi:https://doi.org/10.1016/j.snb.2021.130795.
50. Yuan, R.; Wen, Z.; You, F.; Jiang, D.; Wang, K. Catalysis-Induced Performance Enhancement of an Electrochemical Microcystin-LR Aptasensor Based on Cobalt-Based Oxide on a B, N Co-Doped Graphene Hydrogel. *Analyst* **2021**, *146*, 2574–2580, doi:10.1039/D1AN00236H.
51. Zou, L.; Li, X.; Lai, Y. Colorimetric Aptasensor for Sensitive Detection of Kanamycin Based on Target-Triggered Catalytic Hairpin Assembly Amplification and DNA-Gold Nanoparticle Probes. *Microchemical Journal* **2021**, *162*, 105858, doi:https://doi.org/10.1016/j.microc.2020.105858.
52. Chen, X.-X.; Lin, Z.-Z.; Hong, C.-Y.; Yao, Q.-H.; Huang, Z.-Y. A Dichromatic Label-Free Aptasensor for Sulfadimethoxine Detection in Fish and Water Based on AuNPs Color and Fluorescent Dyeing of Double-Stranded DNA with SYBR Green I. *Food Chem* **2020**, *309*, 125712, doi:https://doi.org/10.1016/j.foodchem.2019.125712.
53. Chen, Y.; Wang, Y.; Yan, P.; Ouyang, Q.; Dong, J.; Qian, J.; Chen, J.; Xu, L.; Li, H. Co3O4 Nanoparticles/Graphitic Carbon Nitride Heterojunction for Photoelectrochemical Aptasensor of Oxytetracycline. *Anal Chim Acta* **2020**, *1125*, 299–307, doi:https://doi.org/10.1016/j.aca.2020.05.038.
54. Li, J.; Shan, X.; Jiang, D.; Chen, Z. An Ultrasensitive Electrochemiluminescence Aptasensor for the Detection of Diethylstilbestrol Based on the Enhancing Mechanism of the Metal–Organic Framework NH2-MIL-125(Ti) in a 3,4,9,10-Perylenetetracarboxylic Acid/K2S2O8 System. *Analyst* **2020**, *145*, 3306–3312, doi:10.1039/D0AN00212G.
55. Khoshbin, Z.; Housaindokht, M.R.; Verdian, A. A Low-Cost Paper-Based Aptasensor for Simultaneous Trace-Level Monitoring of Mercury (II) and Silver (I) Ions. *Anal Biochem* **2020**, *597*, 113689, doi:https://doi.org/10.1016/j.ab.2020.113689.
56. Memon, A.G.; Xing, Y.; Zhou, X.; Wang, R.; Liu, L.; Zeng, S.; He, M.; Ma, M. Ultrasensitive Colorimetric Aptasensor for Hg2+ Detection Using Exo-III Assisted Target Recycling Amplification and Unmodified AuNPs as Indicators. *J Hazard Mater* **2020**, *384*, 120948, doi:https://doi.org/10.1016/j.jhazmat.2019.120948.
57. Mohammadi, A.; Heydari-Bafrooei, E.; Foroughi, M.M.; Mohammadi, M. Electrochemical Aptasensor for Ultrasensitive Detection of PCB77 Using Thionine-Functionalized MoS2-RGO Nanohybrid. *Microchemical Journal* **2020**, *155*, 104747, doi:https://doi.org/10.1016/j.microc.2020.104747.
58. Song, J.; Huang, M.; Jiang, N.; Zheng, S.; Mu, T.; Meng, L.; Liu, Y.; Liu, J.; Chen, G. Ultrasensitive Detection of Amoxicillin by TiO2-g-C3N4@AuNPs Impedimetric Aptasensor: Fabrication, Optimization, and Mechanism. *J Hazard Mater* **2020**, *391*, 122024, doi:https://doi.org/10.1016/j.jhazmat.2020.122024.
59. Song, Y.; Xu, M.; Li, Z.; He, L.; Hu, M.; He, L.; Zhang, Z.; Du, M. Ultrasensitive Detection of Bisphenol A under Diverse Environments with an Electrochemical Aptasensor Based on Multicomponent AgMo Heteronanostructure. *Sens Actuators B Chem* **2020**, *321*, 128527, doi:https://doi.org/10.1016/j.snb.2020.128527.

60. Xu, L.; Duan, W.; Chen, F.; Zhang, J.; Li, H. A Photoelectrochemical Aptasensor for the Determination of Bisphenol A Based on the Cu (I) Modified Graphitic Carbon Nitride. *J Hazard Mater* **2020**, *400*, 123162, doi:https://doi.org/10.1016/j.jhazmat.2020.123162.
61. Mat Zaid, M.H.; Abdullah, J.; Rozi, N.; Mohamad Rozlan, A.A.; Abu Hanifah, S. A Sensitive Impedimetric Aptasensor Based on Carbon Nanodots Modified Electrode for Detection of 17ß-Estradiol. *Nanomaterials* **2020**, *10*, 1346, doi:10.3390/nano10071346.
62. Zhao, Z.; Zheng, J.; Nguyen, E.P.; Tao, D.; Cheng, J.; Pan, H.; Zhang, L.; Jaffrezic-Renault, N.; Guo, Z. A Novel SWCNT-Amplified "Signal-on" Electrochemical Aptasensor for the Determination of Trace Level of Bisphenol A in Human Serum and Lake Water. *Microchimica Acta* **2020**, *187*, 500, doi:10.1007/s00604-020-04475-5.
63. Blidar, A.; Feier, B.; Tertis, M.; Galatus, R.; Cristea, C. Electrochemical Surface Plasmon Resonance (EC-SPR) Aptasensor for Ampicillin Detection. *Anal Bioanal Chem* **2019**, *411*, 1053–1065, doi:10.1007/s00216-018-1533-5.
64. Chen, X.-X.; Lin, Z.-Z.; Hong, C.-Y.; Zhong, H.-P.; Yao, Q.-H.; Huang, Z.-Y. Label-Free Fluorescence-Based Aptasensor for the Detection of Sulfadimethoxine in Water and Fish. *Appl Spectrosc* **2019**, *73*, 294–303, doi:10.1177/0003702818799100.
65. Fan, L.; Wang, G.; Liang, W.; Yan, W.; Guo, Y.; Shuang, S.; Dong, C.; Bi, Y. Label-Free and Highly Selective Electrochemical Aptasensor for Detection of PCBs Based on Nickel Hexacyanoferrate Nanoparticles/Reduced Graphene Oxides Hybrids. *Biosens Bioelectron* **2019**, *145*, 111728, doi:https://doi.org/10.1016/j.bios.2019.111728.
66. Fan, L.; Zhang, C.; Shi, H.; Zhao, G. Design of a Simple and Novel Photoelectrochemical Aptasensor for Detection of 3,3′,4,4′-Tetrachlorobiphenyl. *Biosens Bioelectron* **2019**, *124–125*, 8–14, doi:https://doi.org/10.1016/j.bios.2018.09.054.
67. Liu, X.; Hu, M.; Wang, M.; Song, Y.; Zhou, N.; He, L.; Zhang, Z. Novel Nanoarchitecture of Co-MOF-on-TPN-COF Hybrid: Ultralowly Sensitive Bioplatform of Electrochemical Aptasensor toward Ampicillin. *Biosens Bioelectron* **2019**, *123*, 59–68, doi:https://doi.org/10.1016/j.bios.2018.09.089.
68. Chen, Z.; Li, P.; Cheng, X.; Yang, W.; Wu, Y.; Chen, Q.; Fu, F. Multicolor Aptasensor Based on DNA-Induced Au–Ag Nanorods for Simultaneous and Visual Detection of Inorganic and Organic Mercury. *ACS Omega* **2019**, *4*, 15112–15119, doi:10.1021/acsomega.9b01994.
69. Li, S.; Ma, X.; Pang, C.; Tian, H.; Xu, Z.; Yang, Y.; Lv, D.; Ge, H. Fluorometric Aptasensor for Cadmium(II) by Using an Aptamer-Imprinted Polymer as the Recognition Element. *Microchimica Acta* **2019**, *186*, 823, doi:10.1007/s00604-019-3886-7.
70. Saberi, Z.; Rezaei, B.; Ensafi, A.A. Fluorometric Label-Free Aptasensor for Detection of the Pesticide Acetamiprid by Using Cationic Carbon Dots Prepared with Cetrimonium Bromide. *Microchimica Acta* **2019**, *186*, 273, doi:10.1007/s00604-019-3378-9.
71. Yang, R.; Liu, J.; Song, D.; Zhu, A.; Xu, W.; Wang, H.; Long, F. Reusable Chemiluminescent Fiber Optic Aptasensor for the Determination of 17β-Estradiol in Water Samples. *Microchimica Acta* **2019**, *186*, 726, doi:10.1007/s00604-019-3813-y.
72. Yildirim-Tirgil, N.; Lee, J.; Cho, H.; Lee, H.; Somu, S.; Busnaina, A.; Gu, A.Z. A SWCNT Based Aptasensor System for Antibiotic Oxytetracycline Detection in Water Samples. *Analytical Methods* **2019**, *11*, 2692–2699, doi:10.1039/C9AY00455F.

73. Zhou, N.; Ma, Y.; Hu, B.; He, L.; Wang, S.; Zhang, Z.; Lu, S. Construction of Ce-MOF@COF Hybrid Nanostructure: Label-Free Aptasensor for the Ultrasensitive Detection of Oxytetracycline Residues in Aqueous Solution Environments. *Biosens Bioelectron* **2019**, *127*, 92–100, doi:https://doi.org/10.1016/j.bios.2018.12.024.
74. Ellington, A.D.; Szostak, J.W. Selection in Vitro of Single-Stranded DNA Molecules That Fold into Specific Ligand-Binding Structures. *Nature* **1992**, *355*, 850–852, doi:10.1038/355850a0.
75. Jenison, R.D.; Gill, S.C.; Pardi, A.; Polisky, B. High-Resolution Molecular Discrimination by RNA. *Science (1979)* **1994**, *263*, 1425–1429, doi:10.1126/science.7510417.
76. Mendonsa, S.D.; Bowser, M.T. In Vitro Evolution of Functional DNA Using Capillary Electrophoresis. *J Am Chem Soc* **2004**, *126*, 20–21, doi:10.1021/ja037832s.
77. Mendonsa, S.D.; Bowser, M.T. In Vitro Selection of High-Affinity DNA Ligands for Human IgE Using Capillary Electrophoresis. *Anal Chem* **2004**, *76*, 5387–5392, doi:10.1021/ac049857v.
78. Ashley, J.; Ji, K.; Li, S.F.Y. Selection of Bovine Catalase Aptamers Using Non-SELEX. *Electrophoresis* **2012**, *33*, 2783–2789, doi:https://doi.org/10.1002/elps.201200032.
79. Jing, M.; Bowser, M.T. Isolation of DNA Aptamers Using Micro Free Flow Electrophoresis. *Lab Chip* **2011**, *11*, 3703–3709, doi:10.1039/C1LC20461K.
80. Hybarger, G.; Bynum, J.; Williams, R.F.; Valdes, J.J.; Chambers, J.P. A Microfluidic SELEX Prototype. *Anal Bioanal Chem* **2006**, *384*, 191–198, doi:10.1007/s00216-005-0089-3.
81. Park, S.; Ahn, J.-Y.; Jo, M.; Lee, D.; Lis, J.T.; Craighead, H.G.; Kim, S. Selection and Elution of Aptamers Using Nanoporous Sol-Gel Arrays with Integrated Microheaters. *Lab Chip* **2009**, *9*, 1206–1212, doi:10.1039/B814993C.
82. Daniels, D.A.; Chen, H.; Hicke, B.J.; Swiderek, K.M.; Gold, L. A Tenascin-C Aptamer Identified by Tumor Cell SELEX: Systematic Evolution of Ligands by Exponential Enrichment. *Proceedings of the National Academy of Sciences* **2003**, *100*, 15416–15421, doi:10.1073/pnas.2136683100.
83. Mi, J.; Liu, Y.; Rabbani, Z.N.; Yang, Z.; Urban, J.H.; Sullenger, B.A.; Clary, B.M. In Vivo Selection of Tumor-Targeting RNA Motifs. *Nat Chem Biol* **2010**, *6*, 22–24, doi:10.1038/nchembio.277.
84. Nguyen Quang, N.; Perret, G.; Ducongé, F. Applications of High-Throughput Sequencing for In Vitro Selection and Characterization of Aptamers. *Pharmaceuticals* **2016**, *9*, 76, doi:10.3390/ph9040076.
85. Stoltenburg, R.; Reinemann, C.; Strehlitz, B. FluMag-SELEX as an Advantageous Method for DNA Aptamer Selection. *Anal Bioanal Chem* **2005**, *383*, 83–91, doi:10.1007/s00216-005-3388-9.
86. Lyu, C.; Khan, I.M.; Wang, Z. Capture-SELEX for Aptamer Selection: A Short Review. *Talanta* **2021**, *229*, 122274, doi:https://doi.org/10.1016/j.talanta.2021.122274.