

Waters Sorbent Selection Guide

for Solid-Phase Extraction

REVERSED PHASE

Sorbent/Surface	Description	Typical Applications*	Properties
Oasis® HLB N-Vinylpyrrolidone-DVB copolymer <i>Typical Sample Matrix (see Key below)</i>	Waters patented, strongly hydrophobic, yet water-wettable, polymer with unique hydrophilic-lipophilic balance retains high retention and capacity even if it runs dry after conditioning, enabling high-throughput applications. Highly cross-linked polymer is stable in organic solvents.	<ul style="list-style-type: none"> Drugs and metabolites in biofluids Isolation of peptides and oligonucleotides High-throughput biopolymer desalting Trace organics, priority pollutants, endocrine disruptors JPMHLW official food methods: antibiotics, pesticides 	Particle sizes: 30 and 60 µm Pore size: 80 Å Surface area: 830 m²/g pH range: 0–14
tc₁₈ Silica -SiC ₁₈ H ₃₇	Strongly hydrophobic silica-based bonded phase used to adsorb analytes from aqueous solutions. Trifunctional bonding chemistry for increased hydrolytic stability.	<ul style="list-style-type: none"> JPMHLW official methods for pesticides in water JPMHLW official methods for odorants [geosmin, 2-methyl-isoborneol] in water 	Particle size: 37–55 µm Pore size: 125 Å Surface area: 325 m²/g Carbon load: 17% pH range: 2–8
C₁₈ Silica -Si(CH ₃) ₂ C ₁₈ H ₃₇	Hydrophobic silica-based bonded phase used to adsorb analytes from aqueous solutions. Most widely referenced SPE product for applications such as: drugs and metabolites in biofluids; desalting and isolation of peptides, oligonucleotides; trace organics in environmental water samples; synthetic radiolabeled compound isolation.	<ul style="list-style-type: none"> Lipid fractionation; ganglioside isolation Organic acids in fruit juice, wine JPMHLW and CDFA official methods: pesticides in food Natural products [e.g., steroids, bile acids, prostaglandins, anthocyanins, mycotoxins] AOAC methods for food colors, sugars 	Particle size: 55–105 µm Pore size: 125 Å Surface area: 325 m²/g Carbon load: 12% pH range: 2–8
C₈ Silica -Si(CH ₃) ₂ C ₈ H ₁₇	Moderately hydrophobic silica-based bonded phase used in methods when less retention than that of HLB or C ₁₈ is required.	<ul style="list-style-type: none"> Drugs and their metabolites in biofluids [esp., serum, plasma, urine] Peptides in serum and plasma 	Particle size: 37–55 µm Pore size: 125 Å Surface area: 325 m²/g Carbon load: 9% pH range: 2–8
tc₂ Silica -SiC ₂ H ₅	Weakly hydrophobic silica-based bonded phase used in methods when less retention than that of C ₈ is required. Trifunctional bonding chemistry for increased hydrolytic stability.	<ul style="list-style-type: none"> Applications are similar to those of C₁₈ and C₈ 	Particle size: 37–55 µm Pore size: 125 Å Surface area: 325 m²/g Carbon load: 2.7% pH range: 2–8

REVERSED OR NORMAL PHASE

Aminopropyl Silica -Si(CH ₂) ₃ NH ₂	Moderately polar, silica-based bonded phase with weakly basic surface used as a polar sorbent, like silica, with different selectivity for acidic/basic analytes, or as a weak anion exchanger in aqueous medium below pH 8.	<ul style="list-style-type: none"> Phenols, phenolic pigments, natural products Petroleum fractionation Saccharides Drugs and drug metabolites JPMHLW official methods for pesticides in food 	Particle size: 55–105 µm Pore size: 125 Å Surface area: 325 m²/g Carbon load: 3.5% pH range: 2–8
Cyanopropyl Silica -Si(CH ₂)(CH ₂) ₃ CN	Silica-based bonded phase with low hydrophobicity can be used as a less polar alternative to silica or as a less hydrophobic alternative to C ₁₈ or C ₈ .	<ul style="list-style-type: none"> Drugs and their metabolites Pesticides 	Particle size: 55–105 µm Pore size: 125 Å Surface area: 325 m²/g Carbon load: 6.5% pH range: 2–8
Diol Silica -Si(CH ₂) ₃ OCH ₂ CH(OH)CH ₂ OH	Moderately polar, neutral, silica-based bonded phase used as an alternative to silica in normal-phase applications where the acidic character of silica is undesirable, or as a weakly hydrophobic phase in aqueous media.	<ul style="list-style-type: none"> Antibiotics in cosmetics Protein and peptide isolation by HIC [hydrophobic-interaction chromatography] 	Particle size: 37–55 µm Pore size: 300 Å Surface area: 100 m²/g Carbon load: 2% pH range: 2–8

NORMAL PHASE

Silica SiO ₂	Polar sorbent binds analytes in non-aqueous solvents by H-bonding or dipole interaction; also used as an intermediate-strength cation exchanger in aqueous media, a support for liquid-liquid partition separations, or a solid-phase reagent when suitably coated [e.g., see DNPH below].	<ul style="list-style-type: none"> Vitamins and food additives Lipid classification Synthetic organic compounds Natural products, plant pigments JPMHLW official methods for pesticides in food 	Particle size: 55–105 µm Pore size: 125 Å Surface area: 325 m²/g Activity: High [≤ 3.2% water]
Florisil® MgO•SiO ₂	Polar, highly active, weakly basic sorbent [a co-precipitate of magnesia and silica] for the adsorption of low to moderately polar species from nonaqueous solutions.	<ul style="list-style-type: none"> AOAC and EPA official methods for pesticides JPMHLW official methods for pesticides in food Polychlorinated biphenyls [PCBs] in transformer oil 	Particle size: 50–200 µm Pore size: 60 Å Activity: High [≤ 2.5% water] pH of 10% aqueous slurry: 8.5
Alumina (A,N,B) Al ₂ O ₃	Highly surface-active, polar, acidic [A], neutral [N], and basic [B] sorbents. Unlike silica, alumina exhibits specific π-electron interactions with aromatic hydrocarbons. Acidic and basic alumina are also low-capacity ion exchangers in aqueous media, unaffected by high-energy radioactivity [unlike polymers].	<ul style="list-style-type: none"> Petroleum, synthetic crude oil fractionation [N] Radioactive compound isolation, isotope generators [A,B] Phospholipids, steroids, catecholamines [B] Food, feed additives [A,N], synthetic organic compounds [N] Pesticide, herbicide, priority pollutant isolation [N,B] Alternative to official AOAC and EPA methods [A,N,B] 	Particle size: 50–300 µm Pore size: 120 Å Activity: High, ≤ 1 on Brockmann scale [≤ 1.5% water] pH of 10% aqueous slurry: A: 4 N: 7.5 B: 10

ION EXCHANGE & MIXED MODE

Oasis® MCX N-Vinylpyrrolidone-DVB copolymer -SO ₃ H	Waters patented mixed-mode, reversed-phase/strong cation-exchange, water-wettable polymer, highly selective for bases, used to isolate basic, neutral and acidic compounds with high recoveries. Highly cross-linked polymer is stable in organic solvents.	<ul style="list-style-type: none"> Basic drugs from biofluids and tissue extracts Drug monitoring: screening, identification, confirmation, quantitation Pesticides, herbicides 	Particle sizes: 30 and 60 µm Pore size: 80 Å Surface area: 830 m²/g pH range: 0–14 [pK _a < 1] IEX capacity: 1 meq/g
Oasis® WCX N-Vinylpyrrolidone-DVB copolymer -COOH	Waters patented mixed-mode, reversed-phase/weak cation-exchange, water-wettable polymer used to retain and release strong bases [e.g., quaternary amines]. Highly cross-linked polymer is stable in organic solvents.	<ul style="list-style-type: none"> Strongly basic compounds in biofluids and tissue extracts Drug monitoring: screening, identification, confirmation, quantitation JPMHLW official method for streptomycin and dihydrostreptomycin in vegetable crops 	Particle sizes: 30 and 60 µm Pore size: 80 Å Surface area: 830 m²/g pH range: 0–14 [pK _a ~ 5] IEX capacity: 0.75 meq/g
Accell™ Plus CM Acrylic acid/acrylamide copolymer on diol-silica -COO ⁻ Na ⁺	Silica-based, hydrophilic, weak cation-exchanger with large pore size used to extract cationic analytes in aqueous and non-aqueous solutions.	<ul style="list-style-type: none"> Isolation of cationic proteins [e.g., immunoglobulins, enzymes] Pesticides, herbicides Steroids Inorganic cations in environmental samples 	Particle size: 37–55 µm Pore size: 300 Å pH range: 2–9 Ligand density: 350 µmoles/g Protein-binding capacity: 175 mg Cytochrome c/g
Oasis® MAX N-Vinylpyrrolidone-DVB copolymer -CH ₂ N(CH ₃) ₂ C ₄ H ₉ ⁺	Waters patented mixed-mode, reversed-phase/strong anion-exchange, water-wettable polymer, highly selective for acids, used to isolate acidic, neutral and basic compounds with high recoveries. Highly cross-linked polymer is stable in organic solvents.	<ul style="list-style-type: none"> Acidic compounds and metabolites in biofluids and tissue extracts Drug monitoring: screening, identification, confirmation, quantitation Food additives and contaminants [e.g., Sudan Red] 	Particle sizes: 30 and 60 µm Pore size: 80 Å Surface area: 830 m²/g pH range: 0–14 [pK _a > 18] IEX capacity: 0.25 meq/g
Accell™ Plus QMA Acrylamide-acrylic acid copolymer bound to diol-silica -C(O)NH(CH ₂) ₃ N(CH ₃) ₃ ⁺ Cl ⁻	Silica-based, hydrophilic, strong anion-exchanger with large pore size used to extract anionic analytes in aqueous and non-aqueous solutions.	<ul style="list-style-type: none"> Isolation of anionic proteins [e.g., immunoglobulins, enzymes] Acidic pigments in wine, fruit juices, food extracts Phenolic compounds Peptide pool fractionation Inorganic anions in environmental samples 	Particle size: 37–55 µm Pore size: 300 Å pH range: 2–9 Ligand density: 220 µmoles/g Protein-binding capacity: 200 mg BSA/g
Oasis® WAX N-Vinylpyrrolidone-DVB copolymer -CH ₂ -piperazine	Waters patented mixed-mode, reversed-phase/weak anion-exchange polymer used to retain and release strong acids [e.g., sulfonic acids]. Highly cross-linked polymer is stable in organic solvents.	<ul style="list-style-type: none"> Strongly acidic compounds and metabolites in biofluids and tissue extracts Drug monitoring: screening, identification, confirmation, quantitation Emerging contaminants [e.g., perfluoroacids] 	Particle sizes: 30 and 60 µm Pore size: 80 Å Surface area: 830 m²/g pH range: 0–14 [pK _a ~ 6] IEX capacity: 0.6 meq/g

PRODUCTS FOR SPECIFIC APPLICATIONS

Sep-Pak® DNPH Diphenylhydrazine coated on silica	Acidified dinitrophenylhydrazine reagent coated on silica used for collection of air samples. Aldehydes and ketones react <i>in situ</i> to form hydrazone derivatives; these are then eluted and quantitated by HPLC analysis.	<ul style="list-style-type: none"> EPA Method TO-11A; ASTM D5197 for carbonyl compounds in air JPMOE official methods for aldehydes: odor in outdoor air [short body]; in exhaust gas [long body] 	Particle size: 55–105 µm Pore size: 125 Å Recommended maximum capacity: 75 µg [2.5 µmoles] formaldehyde/cartridge
XPOsure™ Aldehyde Sampler Diphenylhydrazine coated on silica	Acidified dinitrophenylhydrazine reagent coated on silica used for collection of air samples. Aldehydes and ketones react <i>in situ</i> to form hydrazone derivatives; these are then eluted and quantitated by HPLC analysis. Larger particle size optimized for low-pressure personal air monitors.	<ul style="list-style-type: none"> JPMHLW official methods for aldehydes in indoor air EPA Methods TO-11A and IP-6A, ASTM D5197 for carbonyl compounds in air NIOSH Method 2532 for glutaraldehyde in air 	Particle size: 500–1000 µm Pore size: 125 Å Recommended maximum capacity: 70 µg [2.3 µmoles] formaldehyde/cartridge
Ozone Scrubber Potassium iodide	Potassium iodide cartridge is used in series with Sep-Pak® DNPH and XPOsure™ Aldehyde Sampler cartridges to remove ozone interference. Ozone is consumed as it oxidizes iodide to iodine.	<ul style="list-style-type: none"> EPA Method IP-6A and ASTM D5197 for carbonyl compounds in air 	Quantity: 1.4 g KI Capacity: 4.2 mmoles ozone/cartridge [theoretical]
Sep-Pak® Dry Anhydrous Sodium Sulfate	High-capacity desiccant used to remove residual water from normal-phase SPE extracts [in water-immiscible organic solvents].	<ul style="list-style-type: none"> General purpose 	Quantity: 2.85 g anhydrous Na ₂ SO ₄ Theoretical capacity: 3.6 g H ₂ O
Porapak® RDX DVB-N-Vinylpyrrolidone copolymer	Hydrophobic polymer designed to meet or exceed the QA/QC requirements of EPA Method 8330 and reduce solvent consumption 10-fold. It is used by environmental testing labs supporting U.S. Department of Defense remediation programs.	<ul style="list-style-type: none"> Explosives in ground and surface water at ppb level 	Particle size: 125–150 µm Pore size: 200 Å Typical sample volume: 500 mL water/cartridge
Sep-Pak® PS2 Styrene-DVB copolymer	Very hydrophobic copolymer designed for multi-residue pesticide analysis in water samples.	<ul style="list-style-type: none"> JPMHLW official methods for pesticides in water JPMHLW official methods for pesticides in food 	Particle size: 80 µm Quantity: 265 mg/cartridge
Sep-Pak® AC2 Activated carbon	Highly hydrophobic, low ash content, activated carbon used to remove or enrich very polar organic molecules from water.	<ul style="list-style-type: none"> JPMHLW official method for 1,4-dioxane analysis in water Pesticides, herbicides, esp. highly polar small molecules 	Particle size: 85 µm Quantity: 400 mg/cartridge
Carbon Black/Aminopropyl Carbon black Aminopropyl silica	Two-layer sorbent bed used for pesticide cleanup in food matrices prior to GC analysis.	<ul style="list-style-type: none"> JPMHLW official methods for pesticides in food JPMHLW official method for prothiamin 	Particle size: 37–105 µm [carbon black, top layer] 55–105 µm [aminopropyl silica] Quantity: 500 mg of each sorbent, separated by frit

MATRIX KEY	
Aqueous	
Organic	
Gas	

Waters
OASIS
SAMPLE EXTRACTION PRODUCTS



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