Welchrom® SPE Care and Use Manual

Mechanism of SPE

Solid Phase Extraction (SPE) is a separation technique that combines processes such as selective retention and selective elution. Essentially, SPE is also a column chromatography separation process, sharing many similarities with HPLC in terms of separation mechanisms, choice of stationary phase, and solvents. SPE involves an adsorbent extraction process where the sample passes through a packed adsorbent. Analytes and impurities are retained on the column and then selectively removed using specific solvents to elute the analytes, achieving separation. The separation mode of SPE mainly depends on the type of packing material and the properties of the solvents.

Welchrom® SPE Introduction

Welchrom® SPE series, contain silica based SPE, non-silica inorganic SPE, polymeric SPE and mixed-mode SPE.

1. Silica-Based SPE

Silica-based SPE includes C18E(endcapped), C18(not endcapped), C8, Phenyl, Silica, CN, NH_2, PSA(diamine), SCX, SAX, WCX, WAX and PRS etc.

Currently, the most commonly used adsorbents for SPE are still silica gel or bonded silica gel, with a pH range of 2-8. Silica gel-based bonded packing materials offer a wide variety of types, providing the advantage of multiple selectivity options.

2. Non-Silica Inorganic SPE

Non-silica inorganic SPE includes Florisil, Alumina-N (neutral alumina), Alumina-A (acidic alumina), Alumina-B (basic alumina), GraphiCarb, Celite and Polyamide etc.

These adsorbents are all normal-phase adsorbents, and their selectivity and adsorption properties are not exactly the same as those of normal-phase silica gel. They exhibit varying degrees of pola rity and surface basicity and are primarily used for purifying samples from complex matrices before analysis.

3. Mixed mode SPE

Mixed Mode SPE includes C8/SCX, GraphiCarb/NH_2, SiO_2/C18E, C8/CN, special column for tea leaf and etc.

Mixed-mode SPE columns provide a wider range of applications than single-functional group SPE columns due to their multiple interaction forces. They can be used for applications that are challenging for single-functional group SPE columns, such as extracting and separating target compounds from complex sample matrices by utilizing their diverse interaction mechanisms.

4. Polymeric SPE

Polymer–based SPE includes BRP, P-SCX, P-SAX, PS/DVB, P-WCX and P-WAX.

Polymer packing materials overcome the shortcomings of traditional silica gel matrix packing material and their usage in SPE has been increasing year by year. Compared to silica gel matrix, Welchrom SPE polymeric packing material offers the following advantages:

- Wide pH range (0-14), compatible with most organic solvents.
- Polymer surface lacks active hydroxyl groups, eliminating the impact of secondary adsorption that leads to insufficient recovery of alkaline compounds.
- Polymer matrix has a high adsorption capacity for most organic compounds, resulting in higher recovery rates and easier quantitative elution of adsorbed organic compounds, improving reproducibility of analytical results.
- High recovery and adsorption capacity characteristics lower detection limits and reduce the amount of polymer adsorbent needed, without contamination from hydrolysis of bonded phases.
- Spherical particles with a narrow particle size distribution ensure reproducibility of results.
- High interference stability: If the polymer matrix extraction columns accidentally dry out during sample preparation, they can be re-wetted while maintaining their performance without risking the loss of analytes or compromising the reproducibility of results.

Ion chromatography pretreatment column:

IC-RP, IC-P, IC-H, IC-Na, IC-Ag, IC-Ba, IC-A, IC-M

Welchrom® SPE Guide of Usage

1. Reversed packing material (C18, C8, BRP, NH_2, Phenyl, CN, PSA)

Analyte: Non-polarity to medium polarity

Matrix: Aqueous solution

General Extraction Protocol:

Activation: Generally, activate with a water-soluble organic solvent such as methanol, then equilibrate with water.

Washing: Wash impurities with a buffer solution containing 0-50% polar solvent.

Elution: Elute the target compounds with polar or non-polar solvents.

2. Normal packing material(Silica, NH_2, CN, Florisil, Diol, GraphiCarb, Alumina-A/B/N)

Analyte: Medium polarity to strong polarity

Matrix: Non-polarity to medium polarity

General Extraction Protocol:

Activation: Activate with a non-polar organic solvent (usually the same solvent as the sample).

Elution: Elute with a non-polar organic solvent (usually the same solvent as the sample).

3. Anion exchange(SAX, P-SAX)

Analyte: anion(acid) compound

General Extraction Protocol:

Activation: For samples in non-polar organic solvents, activate with the sample solvent. For samples in polar solvents, activate with a water-soluble organic solvent, then equilibrate with water, and finally equilibrate with a buffer solution of appropriate pH.

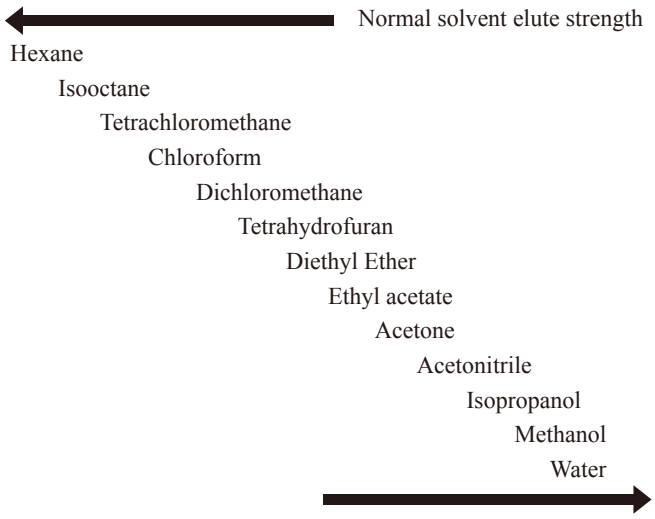
Sample Loading: The pH of the sample solution should be two units greater than its pKa value (to ensure it is in the ionized state).

Elution: The pH of the elution solution should be two units less than its pKa value (to ensure the target compound is in its molecular state).

4. Cation exchange(SCX, PRS, P-SCX)

Analyte: Cation (basic) compound

Activation: For samples in non-polar organic solvents, activate with the sample solution. For samples in polar solvents, pass a water-soluble organic solvent through the column, then equilibrate with water, and finally equilibrate with a buffer solution of appropriate pH.
Sample Loading: The pH of the sample solution should be two units less than its pKa value (to ensure it is in the ionized state).
Elution: The pH of the elution solution should be two units greater than its pKa value (to neutralize the charge and ensure the target compound is in its molecular state).
Note: The same material can be used for different mechanisms. For example, C18 can be used both as a reversed-phase material and as an adsorptive material to adsorb impurities like fats and pigments. Therefore, methods should be designed and operated according to the actual situation.



5. Welchrom IC pretreatment column
(1) IC-RP, IC-P(reversed adsorb mechanism)
Activation: Pass 5 mL of methanol and then 10 mL of ultrapure water through the column, and then let it stand for 10 minutes to ensure full equilibrium.
Purification: Use a syringe to push the sample liquid through the column at a flow rate of approximately 4 mL/min, and keep the column vertical during use. To prevent the activation liquid remaining in the column from diluting the sample liquid, a portion of the sample liquid passing through the column should be discarded. The amount to be discarded depends on the column specifications: for a 1 mL column, discard 3 mL of sample liquid; for a 2.5 mL column, discard 6 mL of sample liquid.

(2) IC-H, IC-Na, IC-Ag, IC-Ba, IC-A(ion exchange mechanism)
Activation: Use a syringe to pass 10 mL of ultrapure water hrough the column at a flow rate of 2 mL/min, keeping the column vertical during use. To prevent the activation liquid remaining in the column from diluting the sample liquid, discard a portion of the sample liquid passing through the column. The amount to be discarded depends on the column specifications: for a 1 mL column, discard 3 mL of sample liquid; for a 2.5 mL column, discard 6 mL of sample liquid.
(3) IC-M(chelate mechanism)
Activation: Use a syringe to pass 10 mL of 2.0 M ammonium acetate solution at pH 5.5 through the column to activate it, then let it stand for 10 minutes to ensure full equilibrium.
Purification: Use a syringe to push the sample liquid through the column at a flow rate of approximately 2 mL/min, keeping the column vertical during use. To prevent the activation liquid remaining in the column from diluting the sample liquid, discard a portion of the sample liquid passing through the column. The amount to be discarded depends on the column specifications: for a 1 mL column, discard 3 mL of sample liquid; for a 2.5 mL column, discard 6 mL of sample liquid.

Storage

Store in a sealed container at room temperature, away from light.

Quality Assurance Measures

• Selection of Materials:
High-quality materials are carefully chosen for each batch.Characteristics such as pore size, pore volume, specific surface area, and carbon loading of the packing material are measured and recorded in relevant quality control charts to ensure quality from the source.
• Production Environment:
Manufactured in a dust-free production workshop with an assembly line process to prevent contamination. The unique SmoothPak™ reproducibility enhancement process ensures exceptionally high batch-to-batch reproducibility of SPE products, guaranteeing stable, accurate, and reliable analytical results for customers.
• After-Sales Service:
Comprehensive after-sales service is provided.

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